NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Science and Engineering

Academic Year

2025-26

5th and 6th Semester Scheme & Syllabus 2025-26

BATCH: 2023-27

CREDITS: 160

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New Horizon College of Engineering, Bangalore

Autonomous College affiliated to VTU, Accredited by NAAC with 'A' Grade & NBA

INSTITUTE VISION AND MISSION

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide services of the highest quality both curricular and co-curricular so that our students can integrate their skills and serve the industry and society equally well at the global level

VALUES

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To emerge as a department of eminence in Computer Science and Engineering in serving the Information Technology Industry and the nation by empowering students with a high degree of technical and practical competence.

MISSION

- To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering
- To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation
- To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Graduate of the program will be able to:

PE01: Develop proficiency as computer scientists with an ability to solve a wide range of computational problems in industry, government, or other work environments.

PE02: Attain the ability to adapt quickly to new environments and technologies, assimilate new information, and work in multi-disciplinary areas with a strong focus on innovation and entrepreneurship.

PE03: Possess the ability to think logically and the capacity to understand technical problems with computational systems.

PE04: Possess the ability to collaborate as team members and team leaders to facilitate cutting-edge technical solutions for computing systems and thereby providing improved functionality.

PEO TO MISSION STATEMENT MAPPING

Mission Statements	PEO1	PEO2	PEO3	PEO4
To strengthen the theoretical and practical aspects of the learning process by strongly encouraging a culture of research, innovation and hands-on learning in Computer Science and Engineering	3	3	3	2
To encourage long-term interaction between the department and the IT industry, through the involvement of the IT industry in the design of the curriculum and its hands-on implementation	3	3	3	2
To widen the awareness of students in professional, ethical, social and environmental dimensions by encouraging their participation in co-curricular and extracurricular activities	2	2	2	3

Correlation: 3 – High, 2 – Medium, 1 – Low

PROGRAM OUTCOMES (POs)

The student will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex Computer Science and engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems in Computer Science and Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problemsand design system components or processes of Computer Science and Engineering that meet the specified needs with appropriate consideration for public health and safety, cultural, societaland environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments in Computer Science and Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

The student will be able to:

PSO1: Ability to design, develop, implement computer programs and use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

PSO2: Work with and communicate effectively with professionals in various fields and pursue lifelong professional development in computing.

MAPPING OF PEOs to POs & PSOs

	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
PEO1	3	3	2	2	2	1	1	1	1	1	1	1	1	1
PEO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2
PEO3	3	3	3	3	3	3	3	2	2	2	2	2	3	3
PEO4	1	1	1	1	1	2	2	3	3	3	3	3	1	1

Correlation: 3 – High, 2 – Medium, 1 – Low

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NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Science and Engineering

Scheme of Teaching and Examinations for 2023 - 2027 BATCH (2022 Scheme)

V - Semester														
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	HSMS	22CSE51	Software Engineering and Project Management	CS	3	0	0	0	3	3	50	50	**100**
2	PCC	22CSE52	Design and Analysis of Algorithms	CS	3	0	0	0	3	3	50	50	**100**
3	PCCL	22CSL52	Design and Analysis of Algorithms Lab	CS	0	0	1	0	1	2	50	50	**100**
4	PCC	22CSE53	Database Management Systems	CS	3	0	0	0	3	3	50	50	**100**
5	PCCL	22CSL53	Database Management Systems Lab	CS	0	0	1	0	1	2	50	50	**100**
6	PEC	22CSE54X	Professional Elective Course-I	CS	3	0	0	0	3	3	50	50	**100**
7	AEC	22RMK55	Research Methodology and IPR	CS	1	1	0	0	2	3	50	50	**100**
8	AEC	22SDK56	Critical and Creative Thinking Skills	CS	0	0	1	0	1	2	50	--	**50**
9	UHV	22ESK57	Environmental Studies	Any Dept	1	0	0	0	1	1	50	50	**100**
10	PROJ	22CSE58	Mini Project-II	CS	0	0	1	0	1	0	50	50	**100**
11	NCMC	22NSS50	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED50	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG50	Yoga	Yoga Teacher									
Total									**19**	**24**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation

Professional Elective Course-I			
22CSE541	Finite Automata and Compiler Design	**22CSE544**	Artificial Intelligence
22CSE542	Introduction to Cloud Computing	**22CSE545**	Advanced Java Programming
22CSE543	Fundamentals of Data Science		

22XXX51 (HSMS)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.

For IT allied Branches: Software Product Management

For Core Branches: Engineering Economics and Management / Industrial Management and Entrepreneurship

Professional Elective Courses (PEC):A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

- A group of 2 if mini project work is single discipline (applicable to all IT allied branches)
- A group of 2-4 if mini project work is single discipline (applicable to all Core Branches)
- A group of 2 -4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

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 faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wiseatthecollegelevelwiththeparticipationofalltheguidesofthe project.

The CIE marks awarded for the Mini-project shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Credit Definition:	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session
1-hour Lecture (L) per week=1Credit	02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
2-hoursTutorial(T) per week=1Credit	01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions
2-hours Practical / Drawing (P) per week=1Credit	
2-hous Self Study for Skill Development (SDA) per week = 1 Credit	

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B. E. in Computer Science and Engineering

Scheme of Teaching and Examinations for 2023 - 2027 BATCH (2022 Scheme)

VI – Semester														
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	PCC	22CSE61	Data Mining and Machine Learning	CS	3	0	0	0	3	3	50	50	**100**
2	PCCL	22CSL61	Data Mining and Machine Learning Lab	CS	0	0	1	0	1	2	50	50	**100**
3	PCC	22CSE62	Computer Networks	CS	3	0	0	0	3	3	50	50	**100**
4	PCCL	22CSL62	Network Simulation Lab	CS	0	0	1	0	1	2	50	50	**100**
5	PCC	22CSE63	Cyber Security Essentials	CS	2	1	0	0	3	4	50	50	**100**
6	PEC	22CSE64X	Professional Elective Course-II	CS	3	0	0	0	3	3	50	50	**100**
7	PROJ	22CSE65	Project Phase-I	CS	0	0	2	0	2	0	50	50	**100**
8	AEC	22SDK66	Problem Solving Skills	CS	0	0	1	0	1	2	50	--	**50**
9	AEC	22CSE67X	Ability Enhancement Course – V	CS	0	0	1	0	1	2	50	50	**100**
10	OEC	22NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	**100**
11	NCMC	22NSS60	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	0	2	50	--	**50**
		22PED60	Physical Education (PE) (Sports and Athletics)	PE Director									
		22YOG60	Yoga	Yoga Teacher									
Total									**21**	**26**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course-II			
22CSE641	Web of Things and IoT	22CSE644	Blockchain Technology
22CSE642	Cloud Architecture Design & Security	22CSE645	Advanced Databases
22CSE643	High Performance Computing		

Ability Enhancement Course–V			
22CSE671	Mobile App Development	22CSE674	Embedded Programming
22CSE672	Data Visualization Tools	22CSE675	Containerization tools
22CSE673	Wearable Technology Programming		

Industrial Open Elective Courses-I:
Credit for OEC is 03 (L: T: P: S) can be considered as(3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. These Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Phase-I: Students have to discuss with the mentor/guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

FIFTH

SEMESTER

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT			
Course Code	**22CSE51**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE51.1	Understand the basics of software development, their process and various model to develop the software products
22CSE51.2	Understand the concept of system requirement, sub system development, architectural design, configuration management and requirement elicitation
22CSE51.3	Apply the knowledge of class, objects, attributes and their relationship to create the class diagram
22CSE51.4	Analyze the process involved in project management and cost benefit evaluation
22CSE51.5	Examine effort estimation techniques and process models with the help of numerical examples
22CSE51.6	Identify, monitor, control and manage risks and resources and also identify best staff selection method.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE51.1	3	3	3	3	2	-	-	-	1	1	-	2	3	2
22CSE51.2	3	3	3	3	2	-	-	-	1	1	-	2	3	2
22CSE51.3	3	3	3	3	2	-	-	-	1	1	-	2	3	2
22CSE51.4	3	3	3	3	2	-	-	-	1	1	-	2	3	2
22CSE51.5	3	3	3	3	2	-	-	-	1	1	-	2	3	2
22CSE51.6	3	3	3	3	2	-	-	-	1	1	-	2	3	2

MODULE-1	**Software Engineering – An Introduction**	**22CSE51.1**	**8 Hours**
Software Engineering – Definition, Software life cycle activities, Challenges in System Development, Software process models: Waterfall, Prototyping, Evolutionary, spiral, unified and agile model, Software development methodology.			
Self-study / Case Study	Software Process Models - Waterfall, Prototyping, Evolutionary, Spiral, Unified, Agile: ● Select one or more process models to study in depth. ● Analyze case studies of projects that successfully used each model to understand their practical applications.		
Text Book	Text Book 1: 1.1-1.3, 2.1 - 2.7		
MODULE-2	**System Synergy: From Requirement To Realization**	**22CSE51.2**	**8 Hours**
System Requirement Definition, System Architectural design, Subsystems development, System integration testing and deployment, System configuration management, System Requirements Elicitation			
Self-study/ Applications	Select an Architectural Pattern: Choose a specific architectural pattern such as the Model View-Controller (MVC), Microservices, or Layered Architecture. Practical Application: Identify a simple software project or system and apply the selected architectural pattern. Create architectural diagrams and documentation to represent your design choices.		
Text Book	Text Book 1: 3.1 - 3.7, 4.1 - 4.7		
MODULE-3	**Modeling The Digital Realm: From Concepts To Visualizations**	**22CSE51.3**	**8 Hours**
Definition, Object-Orientation and Class diagram - class and object, Object and Attribute Association, Multiplicity of Role, Aggregation, Inheritance and Polymorphism, Visualizing domain model.			
Application	**Visualizing Domain Model** Scenario: Create a basic class diagram for your library system with classes, associations, and attributes. Use a piece of paper or diagramming software to draw the diagram.		
Text Book	Text Book 1: 5.1- 5.3,5.4.4		
MODULE-4	**Software Project Management: Principles, Methodologies And Cost-Benefit Strategies**	**22CSE51.4 22CSE51.5**	**8 Hours**

Importance of Software Project Management Methodologies, Categorization of Software Projects, Management Principles, Management Control, Cost-benefit evaluation technology – Risk evaluation - Software process and Process Models Choice of Process models - Rapid Application development, Effort estimation techniques – function points method - COCOMO I Model, agile estimation.

Case Study	Numerical problems and case studies on: 1. Basic Effort Estimation 2. Function Points Estimation 3. CoCoMo I Estimation 4. Cost Benefit Analysis 5. Agile Estimation 6. Risk-based Estimation
Text Book	Text Book 2: 1.1 -1.9, 3.6, 3.7, 4.1- 4.6 Text Book 1: 23.2

MODULE-5	**Mastering Project Risk And Resource Management**	**22CSE51.6**	**8 Hours**

Managing risk, Risk identification, Risk analysis, Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths, Cost schedules, Managing people – Organizational behaviour – Best methods of staff selection, Motivation, The Oldham – Hackman job characteristic model.

Case Study	Numerical problems and case studies on: 1. PERT/ CPM 2. Monte Carlo Simulation 3. MS – Project Hands-on.
Text Book	Text Book 2: 7.1-7.9., 8.1-8.5,8.9, 11.1-11.6

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**		
		Test (s)	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	**5**	**-**	**-**
L2	**Understand**	**5**	**-**	**5**
L3	**Apply**	**5**	**7.5**	**5**
L4	**Analyze**	**5**	**7.5**	-
L5	**Evaluate**	**5**	**-**	**-**
L6	**Create**	**-**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**10**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	**10**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1. Object Oriented Software Engineering" By David Kung edition 2018.
2. Software Project Management by Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edition, Tata McGraw Hill, New Delhi, 2015.

Reference Books:

1. Pearson Edu, "Software Engineering" by Chandramouli, first edition, 2015.
2. Software Project Management: A Unified Framework" by Walker Royce.
3. Managing Global Software Projects McGraw Hill Education (India), Gopalaswamy Ramesh, Fourteenth Reprint 2013.
4. Effective Software Project Management by Robert K. Wysocki – Wiley Publication, 2011.
5. Software Project Management in Practice by Pankaj Jalote, 5th edition 2015.

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc20_cs68/preview**
- **https://onlinecourses.nptel.ac.in/noc19_cs70/preview**
- **https://www.pmi.org/**
- **https://www.computer.org/**
- **https://www.sei.cmu.edu/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Quiz
- PPT presentation on case studies or role play with a team of 4 students

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code	**22CSE52**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE52.1	Understand algorithmic design to solve simple to complex problems using various approaches for algorithm design
22CSE52.2	Apply both brute force and divide-and-conquer design strategies to evaluate an algorithm's effectiveness in devising a solution.
22CSE52.3	Apply from a variety of design techniques to address searching and sorting challenges.
22CSE52.4	Analyze both greedy and dynamic programming strategies for solving intricate problems
22CSE52.5	Evaluate backtracking and branch & bound methods for crafting solutions to real-time problems
22CSE52.6	Interpret the P, NP, and NP-complete complexity classes to scrutinize the constraints and boundaries of an algorithm's performance

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE52.1	3	3	-	3	-	-	-	-	-	-	-	3	3	3
22CSE52.2	3	3	3	3	3	-	-	-	-	-	-	3	3	3
22CSE52.3	3	3	3	3	3	-	-	-	2	-	-	3	3	3
22CSE52.4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
22CSE52.5	3	3	3	3	3	-	-	-	1	-	-	3	3	3
22CSE52.6	3	3	-	3	-	-	-	-	-	-	-	3	3	3

MODULE-1	**Exploring Algorithms and Analyzing Function Growth**	**22CSE52.1**	**8 Hours**

Algorithm introduction, Fundamentals of Algorithmic problem solving, Asymptotic notations, Standard notations and common functions, Important problem types, string processing, graph problems, combinatorial problems, Recurrence-Substitution method, Recursive tree, Mathematical Analysis of Recursive and Non-Recursive Algorithms.

Text Book	Text Book 2: 1.1,1.2,1.3,2.2,2.3,2.4

MODULE-2	**Methods For Evaluating an Algorithm In Order To Devise A Solution**	**22CSE52.2**	**8 Hours**

Brute Force: String matching algorithms – Naive string matching, Rabin Karp & Knuth Morris Pratt. Exhaustive Search, Travelling Salesman problem and Knapsack problem. Divide & Conquer: Merge Sort and Quick sort's performance analysis.

Text Book	Text Book 1:32.1,32.2,32.4Text Book 2: 3.4,4.1,4.2

MODULE-3	**Exploring Search Algorithms and Balanced Trees**	**22CSE52.3, 22CSE52.4**	**8 Hours**

Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting. Transform & Conquer: AVL trees, Heap sort.

Text Book	Text Book 2: 5.1,5.2,5.3,6.3,6.4

MODULE-4	**Optimizing Algorithms for Efficient Problem Solving**	**22CSE52.5**	**8 Hours**

Job scheduling problem, Minimum Spanning tree algorithms – Kruskal's & Prim's, Shortest Path algorithm – Dijkstra's, Huffman Trees, Fractional Knapsack problems. Dynamic Programming: Computing Binomial Coefficients, 0/1 Knapsack problems, Transitive closure - Floyd's algorithm.

Case Study	Explore a case study on "Optimizing Algorithms for Efficient Problem Solving" in the context of job scheduling in a manufacturing facility.
Text Book	Text Book 3: 4.1,4.2.4.4Text Book 2:8.1,8.2,8.4,9.1,9.2,9.3,9.4

MODULE-5	**Algorithmic Frontiers and Strategies**	**22CSE52.6**	**8 Hours**

Decision Trees, Deterministic Polynomial (P), Non-Deterministic Polynomial (NP) & NP complete problems. Backtracking: N Queens problem, Branch & Bound: Travelling Salesman problem, Assignment problem

Self-study	How can advanced algorithmic approaches and computational strategies be leveraged to address complex real-world challenges and optimize processes across different industries and domains.
Text Book	Text Book 2:11.2,11.3,12.1,12.2

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	05	-	-
L2	Understand	05	-	-
L3	Apply	05	7.5	05
L4	Analyze	05	7.5	05
L5	Evaluate	05		-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest & Clifford Stein, "Introduction to Algorithms", fourth edition, 2022, MIT Press, ISBN:9780262367509.
2. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Second Edition, 2017, Pearson Education, ISBN: 978-9332585485.
3. Ellis Horowitz, Satraj Sahni and Rajasekaran, "Computer Algorithms/C++ ", 2nd Edition, 2019, The Orient Blackswan, ISBN: 978-9386235145.

Reference Books:

1. Anuradha A. Puntambekar, "Analysis and Design of Algorithms", 2020, Technical Publications, ISBN: 9789333223867.
2. Design and Analysis of Algorithms, S. Sridhar, 2014, Oxford University Press, ISBN: 9780198093695.

Web links and Video Lectures (e-Resources):

- https://rcet.org.in/uploads/academics/rohini_20313798233.pdf
- https://www.javatpoint.com/daa-rabin-karp-algorithm
- https://www.javatpoint.com/daa-knuth-morris-pratt-algorithm
- https://www.javatpoint.com/greedy-algorithms
- https://www.javatpoint.com/dynamic-programming
- https://www.javatpoint.com/backtracking-introduction
- https://www.javatpoint.com/backtracking-introduction

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning:

- **Algorithmic Problem Solving Sessions:** conducting regular problem-solving sessions where students work in groups to solve algorithmic problems from basic to advanced to devise solutions collaboratively.
- **Algorithm Visualization and Simulation:** Practice interactive algorithm visualization and simulation tools to visually observe how algorithms work in real-time. Modify algorithms by changing the input parameters, and analyze the effects on algorithm performance. This approach promotes active engagement and allows to gain insights into algorithm behavior through experimentation.

DESIGN AND ANALYSIS OF ALGORITHMS LAB

Course Code	**22CSL52**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

22CSL52.1	Understand the intricacies of sorting problems through application of various algorithmic methods.
22CSL52.2	Apply optimized algorithms to address a range of problems effectively.
22CSL52.3	Analyse decrease and conquer techniques to address graph traversal problems
22CSL52.4	Evaluate various algorithmic design techniques to find the shortest path and state free space for a given problem.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSL52.1	3	3	3	3	3	-	-	-	-	-	-	3	3	1
22CSL52.2	3	3	3	3	3	-	-	-	-	-	-	3	3	1
22CSL52.3	3	3	3	3	3	-	-	-	-	-	-	3	3	1
22CSL52.4	3	3	3	3	3	-	-	-	-	-	-	3	3	1

Exp. No. / Pgm. No.	**List of Experiments / Programs**	**Hours**	**COs**
	Prerequisite Experiments / Programs / Demo		
	• **Demo of C++ Installation with Simple Programs**	2	NA
	PART-A		
1	a) Develop a program to calculate the greatest common divisor (GCD) of two numbers using both Euclid's algorithm and the consecutive integer checking algorithm. b) Create a program to apply the Sieve of Eratosthenes method for generating prime numbers within a specified range.	2	**22CSL52.1**
2	Develop a program to perform string matching using the Rabin-Karp Algorithm	2	**22CSL52.1**
3	Examine the time complexity of Merge Sort through the application of the divide and conquer technique	2	**22CSL52.2**
4	Examine the time complexity of Quick Sort employing the divide and conquer technique.	2	**22CSL52.2**
5	Create a program for implementing the heap sort algorithm.	2	**22CSL52.3**
6	Develop a program that implements the Topological Sorting algorithm, allowing the systematic arrangement of elements in a directed acyclic graph (DAG) based on their dependencies and order of execution	2	**22CSL52.3**
	PART-B		
7	Given a connected Graph of some number of vertices , develop a program to find Minimum Spanning Tree of graph by applying Kruskal's algorithm.	2	**22CSL52.4**
8	Develop a program to implement the 0/1 Knapsack problem using A] Dynamic Programming method B] Greedy method	2	**22CSL52.4**
9	Design a program that utilizes Prim's Algorithm to determine the minimum cost spanning tree within a given graph. This algorithm systematically selects edges while ensuring that the resulting tree remains connected and has the lowest possible total edge weight	2	**22CSL52.4**

10	Create a comprehensive program that utilizes Dijkstra's Algorithm to determine the shortest path between nodes in a given graph. This algorithm systematically explores and updates the distances from a selected source node to all other nodes, ensuring an efficient and accurate path calculation	2	**22CSL52.4**
11	Design a program that calculates the Binomial Coefficient, often denoted as C(n, r), representing the number of ways to choose 'r' items from a set of 'n' items without regard to the order of selection. This program should provide an efficient and accurate method for determining this combinatorial value.	2	**22CSL52.4**
12	Develop a comprehensive program that employs the Backtracking technique to solve the N Queens problem. This classic problem involves placing 'N' chess queens on an 'N x N' chessboard in such a way that no two queens threaten each other, ensuring that no queen can attack any other queen horizontally, vertically, or diagonally	2	**22CSL52.4**

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Assessment	Test (s)
		30	20
L1	Remember	-	--
L2	Understand	-	05
L3	Apply	10	05
L4	Analyze	10	05
L5	Evaluate	10	05
L6	Create	--	--

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Anany Levitin, "Introduction to the Design & Analysis of Algorithms", Second Edition, 2017, Pearson Education, ISBN: 978-9332585485.
2) Design and Analysis of Algorithms, S. Sridhar, 2014, Oxford University Press, ISBN: 9780198093695

DATABASE MANAGEMENT SYSTEMS			
Course Code	**22CSE53**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE53.1	Understand the database concepts, architecture, components, and basics of the ER model.
22CSE53.2	Apply the concepts of DDL, DML, DCL and TCL for the given scenario.
22CSE53.3	Illustrate the use of joins, view, trigger, and assertion on various database.
22CSE53.4	Evaluate the concept of functional dependencies and normalization techniques to refine databases.
22CSE53.5	Illustrate Cassandra's components and operations alongside MongoDB.
22CSE53.6	Estimate NoSQL features, CAP, ACID vs. BASE, and types.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE53.1	3	3	-	-	3	-	-	-	-	-	-	-	3	3
22CSE53.2	3	3	3	-	3	-	-	-	-	-		-	3	3
22CSE53.3	3	3	3	-	3	1	-	-	1	1	1	1	3	3
22CSE53.4	3	3	3	-	3	1	-	-	1	1	1	1	3	3
22CSE53.5	3	3	3	-	3	1	-	-	1	1	-	1	3	3
22CSE53.6	3	3	3	-	3	1	-	-	1	1	1	1	3	3

MODULE-1	**Database Fundamentals and Entity-Relationship Model**	**22CSE53.1**	**8 Hours**

Introduction to Database: Definition – Database and DBMS, Characteristics of Database approach, Advantages of using DBMS approach.
Database Concept and Architecture: Data models and schemas, Three-tier architecture and data independence, Components of DBMS, Roles and responsibilities of Database Designer, Administrator and Users.
Introduction to Entity-Relationship Model: Entity Types, Attributes and Keys, Relationship types, Roles and Structural Constraints, Weak Entity Types, ER Diagrams, Reduction of an E-R schema to relational Tables.

Self-study	Investigate diverse database types, such as relational and object-oriented databases, and grasp the strengths and weaknesses of each.
Text Book	Text Book 1: 1.3, 1.6, 2.2, 3.3, 3.4, 3.6

MODULE-2	**Introduction to Logical Design and Relational Model**	**22CSE53.2**	**8 Hours**

Introduction to Logical Design and Relational Model: Domains, Attributes, Tuples, and Relations, Relational Database Schemas.
Introduction to SQL: Concepts of Data Definition Language (DDL) and Data Manipulation Language (DML) and Data Query Language (DQL), DDL – create, alter, drop, truncate and Data constraints and its types, DML – insert, update, delete, DCL – grant, revoke, TCL – commit, rollback, savepoint, Filter data, Orderby, Groupby, Operators, Aggregate function.

Case Study	Create a relational database for a university management system, this case study encompasses entities such as students, courses, professors, departments, and enrollment details. Participants will generate tables for each entity and establish the relationships between them while employing DDL, DML, and DQL statements.
Text Book	Text Book 1: 5.2, 6.1, to 6.5

MODULE-3	**Advanced SQL Queries, Views, and Index Structures in Database Management**	**22CSE53.3**	**8 Hours**

SQL Queries: Joins and its types, Nested Queries, Correlated Nested Queries, Views - create, update, Assertion and Trigger.
Index Structures: Indexes on Sequential Files - dense, sparse, multilevel, Hash Based Indexing: Static and dynamic.

Applications	Examine SQL join queries through the creation of databases such as Social Media Analytics, Online Banking System, Inventory Tracking System, and Online Movie Database		
Text Book	Text Book 2: 7.2,7.3,7.4, 17.1, 17.4		
MODULE-4	**Database Design and Transaction Management**	**22CSE53.4**	**8 Hours**
Database Refinement: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normalization on Relational Databases - 1NF,2NF,3NF, BCNF. Scenarios and use cases on normalization. **Transaction Management:** ACID Properties Transactions and Schedules.			
Case Study	Discover functional dependencies among attributes and systematically normalize the database to attain higher normal forms (1NF, 2NF, 3NF, and BCNF). Additionally, participants can incorporate transaction management to address the concurrent order placement and information updating by multiple users.		
Text Book	Text Book 1: 14.1 to 14.5		
MODULE-5	**Exploring Cassandra and NoSQL Databases**	**22CSE53.5 22CSE53.6**	**8 Hours**
Introduction to Cassandra: Architecture, Gossip protocol, Snitches, Virtual Nodes, Read and Write operation, indexing, compaction, Anti-entropy, Tombstones. MongoDB **NOSQL Databases:** Features, CAP Theorem, ACID v/s BASE, Advantages & Disadvantages of NOSQL, Types of NOSQL - Key-Value, Document-based, Column-based and Graph-based.			
Case Study	Examine the compromises involved in balancing data consistency and system availability while designing the database schema and configuring read and write consistency levels. Also, explore how vNodes and replication factor choices affect data distribution and system fault tolerance.		
Text Book	Text Book 3: 1.2 to 1.7		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	-	-
L3	Apply	10	7.5	5
L4	Analyze	5	7.5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe: Fundamentals of Database Systems, 7th Edition, Pearson ,2016. ISBN: 9780133970777.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts",7th Edition, July 2021, ISBN: 9781260447857
3. Jeff Carpenter, Eben Hewitt, "Cassandra: The Definitive Guide" Publisher: O'Reilly Media, 2nd edition 2019, ISBN-13: 978-1491933664.

Reference Books:

1. Nathan Clark "Learn SQL Database Programming: Queries and Relationships for Beginners" published Year: 2020 ISBN-13: 979-8663379361.
2. Thomas M. Connolly, Carolyn E. Begg, Database Systems: A Practical Approach to Design, Implementation, and Management", Pearson Year: 2019 ISBN-13: 978-0134801265.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_cs79/preview
- https://www.youtube.com/watch?v=DRSog3SA4-Y&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
- https://www.youtube.com/watch?v=f1oV46r69YM

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Database Design Activity:** Participate in teams and present a scenario of real-world challenge that necessitates the creation of a database.
- **SQL Query Challenge:** Attend the SQL query challenge where students are given a set of complex data retrieval tasks. Each task should involve multiple tables and require the use of joins, nested queries, and aggregation functions.
- **Normalization Workshop:** Attend a workshop, where students are tasked with employing normalization techniques (1NF, 2NF, 3NF, BCNF) to elevate tables to higher normal forms. The objective is to eliminate data redundancy and preserve data integrity throughout the process.

DATABASE MANAGEMENT SYSTEMS LAB

Course Code	**22CSL53**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

22CSL53.1	Draw ER diagrams with the given constraints and map relational schema.
22CSL53.2	Apply the concepts of DDL, DML, DCL, TCL to various databases and joins to perform nested and correlated queries.
22CSL53.3	Evaluate user-defined view, Trigger, Assertion to the database of any given scenario.
22CSL53.4	Examine NoSQL databases and execute CRUD (Create, Read, Update, and Delete) operations within the Cassandra database, MongoDB.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSL53.1	3	3	3	-	-	-	-	-	-	-	1	-	3	-
22CSL53.2	3	3	3	-	3	-	-	-	-	-	1	3	3	3
22CSL53.3	3	3	3	-	3	-	-	-	-	-	1	3	3	3
22CSL53.4	3	3	3	-	3	-	-	-	-	-	1	3	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Demo on installation of SQL • Demo on installation of NoSQL	2	NA
	PART-A		
1	Installation and setup procedures to configure a DBMS.	02	22CSL53.1
2	Draw an ER Diagram for a given scenario and transform the same to Relational data base schema (University Database, General Hospital Database)	02	22CSL53.1
3	Implement Data Definition Language commands and Data Manipulation Language commands for the given scenario.	02	22CSL53.2
4	Apply various data constraints, DCL and TCL commands on various databases.	02	22CSL53.2
5	Apply different Aggregate functions, groupby, having and Order-by clauses for the given problem statement.	02	22CSL53.2
6	Apply relational-logical operators, string operations and additional operators for the given problem statement.	02	22CSL53.2
	PART-B		
7	Analyze Joins and its types, Nested and Correlated Nested queries for the given scenario.	02	22CSL53.2
8	Create/replace single table view and multiple tables view, update and drop views for the given relation.	02	22CSL53.3
9	Create and drop Triggers for various events such as insert, update and delete transactions.	02	22CSL53.3
10	Design and implement the relations using Cassandra NoSQL DB.	02	22CSL53.4
11	Demonstrate how to create and drop a database in MongoDB.	02	22CSL53.4
12	Creating the collection in MongoDB on the fly.	02	22CSL53.4

PART-C
Beyond Syllabus Virtual Lab Content
https://vsit.edu.in/dbms/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Assessment	Test (s)
		30	**20**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	10	10
L4	**Analyze**	10	5
L5	**Evaluate**	5	-
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**30**
L4	**Analyze**	**10**
L5	**Evaluate**	**-**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts",7th Edition, July 2021
2. Jeff Carpenter, Eben Hewitt," Cassandra: The Definitive Guide" Publisher: O'Reilly Media, 2nd edition 2019, ISBN-13: 978-1491933664.

FINITE AUTOMATA AND COMPILER DESIGN			
Course Code	**22CSE541**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE541.1	Understand the fundamental concepts of Formal language and Automata and Design the DFA & NDFA for a given language.
22CSE541.2	Discuss automata and computational for the Regular Expressions.
22CSE541.3	Compute PDA's and CFG's for different languages
22CSE541.4	Analyze Turing machines for different languages and understand phases of compiler.
22CSE541.5	Interpret Syntax analyzer and Top-down parser for given grammars and parse the given strings
22CSE541.6	Evaluate Bottom-up parsing for given grammars, generate and optimize the code.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE541.1	3	3	2	2	-	-	-	-	-	-	-	2	2	2
22CSE541.2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
22CSE541.3	3	3	2	2	-	-	-	-	-	-	-	2	2	2
22CSE541.4	3	3	2	2	-	-	-	-	-	-	-	2	2	2
22CSE541.5	3	3	2	2	-	-	-	-	-	-	-	2	2	2
22CSE541.6	3	3	2	2	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Introduction to Finite Automata**	**22CSE541.1, 22CSE541.2**	**8 Hours**

Introduction to Finite Automata: Central Concepts of Automata, Types of Finite Automata-DFA,NFA,∈-NFA, Conversion of NFA to DFA using subset construction method

Regular expressions and Language: Regular Expressions, Minimization of DFA, Chomsky Hierarchy

Applications	Applications of Finite Automata & regular expressions in numerous practical applications in computer science such as linguistics, software engineering, and other fields.
Text Book	Text Book 1: Chapter:1,2 - 1.1, 1.5, 2.1, 2.2, 2.3, 2.5

MODULE-2	**Context-Free Grammars**	**22CSE541.3**	**8 Hours**

Context-Free Grammars: Writing CFG, Parse trees, Ambiguity in grammars, Simplification of CFG, **Pushdown Automata:** Language of PDA, Writing PDA's

Self-study	Implement algorithms for converting CFGs to CNF or GNFA in a programming language of your choice. Write PDA simulations for simple languages.
Text Book	Text Book 1: chapter 5,6 : 5.1, 5.2, 6.1,6.2, 6.4

MODULE-3	**Turing Machine & Compiler Design**	**22CSE54.4**	**8 Hours**

Turing Machine: Language of TM, Writing TM; Multitape TM, Multi -Track TM, NDTM;

Introduction to Compiler Design: Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer– Specification of Tokens

Case Study	Select a specific problem or concept related to Turing Machines and perform a case study. For example**:** **Busy Beaver Problem**: Investigate the Busy Beaver function that calculates the maximum number of steps a halting Turing Machine can run on a blank tape. Turing Machine Simulations: Create a simulation of a Turing Machine in a programming language of your choice to understand its behavior and operations.
Text Book	Text Book 1: chapter 8-8.1,8.2 , 8.4 Text Book 2: 1.1,1.2,

MODULE-4	**Compiler Design –Syntax Analysis and Top-Down Parsing**	**22CSE541.5**	**8 Hours**

Introduction to Compiler Design: Transition Diagrams in Recognition of Tokens **Syntax Analysis**: Role of parser, Types of parsers, **Top Down parsing** -General Strategies Recursive Descent Parser, Predictive Parser-LL(1) Parser

Self-study	Select a simple programming language subset and write its CFG. Construct an LL(1) parsing table for the CFG. Implement a recursive descent parser for the language in a programming language of your choice.
Text Book	Text Book 2: 2.6,2.7,3.1- 3.4,4.1-4.4

MODULE-5	**Compiler Design –Bottom Up Parsing**	**22CSE541.6**	**8 Hours**

Bottom-Up Parsing: Introduction to Shift reduce Parsing, LR parsing - LR (0) Item, Construction of LR (0) Parsing Table Intermediate code generation and optimization, Design of a simple Code generator

Case Study	Look for online courses on platforms like Coursera, edX, and Udemy that cover compiler design topics, including bottom-up parsing and do case study for the same
Text Book	Text Book 2: 4.5,4.6,6,8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**	
		Test (s)	**Qualitative Assessment (s) NPTEL**
		25	**25**
L1	**Remember**	**5**	**5**
L2	**Understand**	**5**	**5**
L3	**Apply**	**5**	**5**
L4	**Analyze**	**5**	**5**
L5	**Evaluate**	**5**	**5**
L6	**Create**	**-**	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	-
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	-
L6	**Create**	

Suggested Learning Resources:

Text Books:

1. "Introduction to Automata Theory, Languages and Computation", John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, 3 rd Edition, Pearson Education, 2011
2. "Compilers- Principles, Techniques and Tools", Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman, 2nd Edition, Pearson Education, 2013

Reference Books:

1. "Theory of Computer Science, Automata, Languages, and Computation", K.L.P. Mishra 3 rd Edition, PHI Learning, 2009
2. "Compiler Design", K. Muneeswaran, OXFORD university Press, 2015

Web links and Video Lectures (e-Resources):

- https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/
- https://www.tutorialspoint.com/automata_theory/
- https://www.youtube.com/playlist?list=PLEbnTDJUr_IcPtUXFy2b1sGRPsLFMghhS

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Problem Solving approach
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues

INTRODUCTION TO CLOUD COMPUTING			
Course Code	**22CSE542**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE542.1	Exhibit the foundational concepts of cloud computing.
22CSE542.2	Comprehend virtualization, containerization, and cloud resource management techniques to solve real-world scalability challenges.
22CSE542.3	Recognize the knowledge of PaaS, DBaaS, and Micro Services.
22CSE542.4	Apply the knowledge to develop, deploy, and scale cloud applications using PaaS, DBaaS, and micro services.
22CSE542.5	Analyze cost optimization techniques in the cloud.
22CSE542.6	Evaluate comprehensive plans for executing a successful cloud migration.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE542.1	3	3	3	3	2	-	-	-	**-**	**-**	-	2	3	**-**
22CSE542.2	3	3	3	3	2	-	-	-	**-**	**-**	-	2	3	**-**
22CSE542.3	3	3	3	3	2	-	-	-	**-**	**-**	-	2	3	**-**
22CSE542.4	3	3	3	3	2	-	-	-	**-**	**-**	-	2	3	**-**
22CSE542.5	3	3	3	3	2	-	-	-	**-**	**-**	-	2	3	**-**
22CSE542.6	3	3	3	3	2	-	-	-	**-**	**-**	**-**	2	3	**-**

MODULE-1	**Introduction to Cloud Computing**	**22CSE542.1**	**8 Hours**
Cloud Computing Definition, Historical Evolution of Cloud Computing, Benefits and Advantages of Cloud Computing, Cloud Service Models: IaaS, PaaS, SaaS, Cloud Deployment Models: Public, Private, Hybrid, Community, Cloud Computing Providers: AWS, Azure, Google Cloud, and Others			
Case Study	Real-world examples of cloud adoption • Netflix • Airbnb • Dropbox		
Text Book	Text Book 1: Chapter 1		
MODULE-2	**Cloud Infrastructure and Virtualization**	**22CSE542.2**	**8 Hours**
Virtualization Concepts and Technologies, Hypervisors and Virtual Machines (VMs), Containers and Containerization (Docker, Kubernetes), Infrastructure as a Service (IaaS) Providers, Managing Virtual Resources in the Cloud, Scalability and Elasticity.			
Applications	• Creating a Virtual Machine. • Managing Virtual Machines • Creating Custom Images • Launching VMs from Custom Images • Managing Snapshots and Backups • Auto-Scaling		
Text Book	Text Book 2 : Chapter 1,2,3 Text Book 1: Chapter 5,6		
MODULE-3	**Cloud Services**	**22CSE542.3, 22CSE542.4**	**8 Hours**
Introduction to Platform as a Service (PaaS), Popular PaaS Providers (e.g., Heroku, Google App Engine), Developing, Deploying, and Scaling Applications in the Cloud, Database as a Service (DBaaS), Microservices Architecture Serverless Computing.			
Case Study	Building and Deploying Web Applications in the Cloud • E-Commerce Website Migration to AWS • Serverless Web App on Google Cloud Platform		
Text Book	Text Book 1: Chapter 9 -10		
MODULE-4	**Cloud Cost Management and Optimization**	**22CSE542.5**	**8 Hours**

Cloud Cost Management - Cost Structure, Total Cost of Ownership (TCO) vs. Cloud Costs, Importance of Cost Optimization, Cost Tracking and Analysis - Cloud Billing and Cost Allocation, Cloud Cost Dashboards and Reporting, Identifying Cost Drivers and Anomalies, Cost Optimization Strategies - Rightsizing Resources: VMs, Storage, and Databases, Cloud Cost Tools and Services - Cloud Cost Management Tools (e.g., AWS Cost Explorer, Azure Cost Management)

Applications	• Cost Analysis and Optimization. • Data Transfer Cost Management.
Text Book	Text Book 1: 19, 20

MODULE-5	**Cloud Migration and Management**	**22CSE542.6**	**8 Hours**

Cloud Migration Strategies: Rehost, Refactor, Rearchitect, Planning and Executing a Cloud Migration, Cost Optimization in the Cloud, Cloud Governance and Management Tools, Cloud Service Management (e.g., AWS Management Console, Azure Portal), Future Trends and Innovations in Cloud Computing

Case Study	• Dropbox's Migration to AWS • Netflix's Cloud Adoption with AWS • Airbnb's Cloud Transition with AWS
Text Book	Text Book 1: Chapter 2

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		**Marks Distribution**	
		Test (s)	**Qualitative Assessment (s) NPTEL**
		25	**25**
L1	**Remember**	5	**5**
L2	**Understand**	5	**5**
L3	**Apply**	5	5
L4	**Analyze**	5	5
L5	**Evaluate**	5	5
L6	**Create**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**10**
L2	**Understand**	**10**
L3	**Apply**	**20**
L4	**Analyze**	**10**
L5	**Evaluate**	**-**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1) Cloud Computing: Principles and Paradigms, by Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Wiley, 2011.
2) Virtualization Essentials, Matthew Portnoy and David K, Wiley, 2016.

Reference Books:

3) White, S., & Johnson, P. (2018). Cloud Migration Strategies: A Comparative Study. International Journal of Cloud Computing and Services Science, 7(2), 50-60.
4) Wang, Y., & Lee, W. (2019). Cost Optimization in Cloud Computing: A Survey. IEEE Access, 7, 90498-90515.

Web links and Video Lectures (e-Resources):

https://docs.aws.amazon.com
https://cloud.google.com/docs
https://docs.microsoft.com/en-us/azure
https://www.coursera.org/courses?query=cloud%20computing
https://cloudcomputing-news.net
https://github.com/topics/cloud-computing

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- NPTEL
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

FUNDAMENTALS OF DATA SCIENCE			
Course Code	**22CSE543**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE543.1	Understand the fundamental concepts of data science.
22CSE543.2	Apply acquire knowledge on the mathematical foundations required for data science.
22CSE543.3	Analyze the probability theory and Bayesian model for predicting futuristic data.
22CSE543.4	Investigate the data using inferential statistical models to draw insights for the society.
22CSE543.5	Evaluate different mathematical models and identify the suitable model for a given application.
22CSE543.6	Interpret the data using visualization techniques.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE543.1	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE543.2	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE543.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE543.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE543.5	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE543.6	3	3	3	3	2	-	-	-	-	-	-	2	3	3

MODULE-1	**Introduction To Data Science**	**22CSE543.1**	**8 Hours**

What is Data Science- Basic Terminology, Why Data Science, Data Science life cycle - Data science classification- Data Science Process- Retrieving Data- Integrating and transforming data-Data Preparation-Data modeling- Application- Data Exploration- Datasets-Descriptive statistics, Tools for data science.

Text Book	Text Book 1: 1.3, 1.5, 1.6

MODULE-2	**Mathematical Foundation For Data Science**	**22CSE543.2**	**8 Hours**

Matrices, Vectors and their properties (determinants, traces, rank, nullity, etc.); Inner products; Distance measures; Projections; Notion of hyper planes; half-planes; Positive definite matrices; Eigenvalues and eigenvectors.

Text Book	Text Book 1: 3.4, 3.6 and Text Book 2: 4.1,4.2,4.3

MODULE-3	**Advanced Probability**	**22CSE543.3, 22CSE543.4**	**8 Hours**

Probability: Sample space, events and axioms; conditional probability; Bayes theorem; Random variables; Standard discrete and continuous probability distributions; Covariance and correlation; Central limit theorem.
Inferential Statistics: Point estimates, sampling distributions, confidence interval, hypothesis tests, Analysis of variance, ANOVA, One way and two-way classifications.

Case Study	Case-study on sampling methods.
Text Book	Text Book 2: 2.4, 2.5, 2.6

MODULE-4	**Algorithms For Data Science**	**22CSE543.5**	**8 Hours**

Basic algorithms under supervised- Logistic Regression, Decision Trees, Random Forest, Support Vector Machines (SVM) and Gradient Boosting Machines (GBM) and unsupervised learning methods- K-means clustering, KNN (k-nearest neighbors), Anomaly detection, Principle Component Analysis, Independent Component Analysis. Ensemble Learning- Bayes optimal classifier, Bootstrap aggregating and Time Series Modeling.

Case Study	Real world data science case study on • Health care diagnostics, • Fraud prevention in finance, • Urban planning and smart city.
Text Book	Text Book 1: 5.3, 5.4, 5.5,5.6

MODULE-5	**Data Visualization**	**22CSE543.6**	**8 Hours**

What is Data Visualization, Data Visualization Tools,History of Tableau, Tools of Tableau, Architecture of

Tableau, Data Connection, Tableau Calculations, Tableau Filter Data, Power BI Architecture- Supported Data Source, Data Modeling, Visualization Options, Charts & Graphs.	
Case Study	Data visualization case study on • Sales and marketing analytics, • Operational analytics, • Financial analytics.
Text Book	Text Book 3: Chapter 1, 2, 3 and Text Book 4: Chapter 3, 4, 5 6.2, 6.3, 6.4

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Doing Data Science : Straight Talk from the Front line" , " CathyO' Neil , Rachel Schutt , " O' Reilly Media, 2013
2. Matrix Computations by Gene H. Golub, C.F. Van Loan, The Johns Hopkins University Press.
3. Learning Tableau 2019, Third Edition, Tools for Business Intelligence, data prep, and visual analytics, Joshua N. Milligan.
4. Introducing Microsoft Power BI, Published by Microsoft Press, ISBN: 978-1-5093-0228-4, Alberto Ferrari and Marco Russo.

Reference Books:

1. " Data Science from Scratch First Principles with Python", " Joel Grus" O' Reilly Media, 2015
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=10e-b8AgdVA
- https://www.youtube.com/watch?v=PFDu9oVAE-g
- https://www.youtube.com/watch?v=XQoLVl31ZfQ
- https://www.youtube.com/watch?v=gWZtNdMko1k&list=PLWPirh4EWFpGXTBu8ldLZGJCUeTMBpJFK
- https://www.youtube.com/watch?v=NNSHu0rkew8
- https://www.youtube.com/watch?v=H84UJn1CiWo&list=PL6Omre3duO-OGTAMuFuDOS8wMuuxmyaiX

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Contents related activities (Activity-based discussions)

- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars

ARTIFICIAL INTELLIGENCE

Course Code	**22CSE544**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE544.1	Understand the basic concepts of Artificial Intelligence and the searching techniques for searching and solving any AI problem
22CSE544.2	Summarize different logics to represent knowledge, reasoning patterns in propositional logic and derive the proof from the facts using inference
22CSE544.3	Compute statistical reasoning problems, Bayes theorem and Bayesian Networks
22CSE544.4	Analyze different forms of learning with real world examples
22CSE544.5	Interpret the concept of different game playing techniques
22CSE544.6	Evaluate different AI techniques used in planning

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE544.1	3	3	-	-	-	-	-	-	-	2	-	2	-	-
22CSE544.2	3	3	3	-	-	-	-	-	-	2	-	-	3	-
22CSE544.3	3	3	3	-	-	-	-	-	-	2	-	2	3	-
22CSE544.4	3	3	3	-	-	-	-	-	-	2	-	-	-	-
22CSE544.5	3	3	3	2	-	-	-	-	-	2	-	-	3	-
22CSE544.6	3	3	3	2	-	-	-	-	-	2	-	2	3	3

MODULE-1	**Introduction To AI**	**22CSE544.1**	**8 Hours**

Foundations of AI, Problem solving, Problem Definition and characteristics, Spaces and search, Heuristic search technique –Generate and test, Hill climbing, Best first search, problem reduction.

Case Study	**Real world applications of AI. Any one application in detail.**
Text Book	Text Book 1: 1.1 to 1.4, 3.1 to 3.6 Text Book 2: 1.1 to 1.3,2.1 to 2.4,3.1 to 3.3

MODULE-2	**Knowledge Representation**	**22CSE544.2**	**8 Hours**

Knowledge-based agents, the Wumpus world as an example world, Logic, propositional logic, Reasoning patterns in propositional logic, Agents based on propositional logic,Syntax and semantics of first-order logic, Using first-order logic, Knowledge engineering in first-order logic

Case Study	**Case Study on Knowledge Based Agents**
Text Book	Text Book 1: 7.1 to 7.7, 8.1-8.4, 9.1 Text Book 2:4.1,4.2,5.1 to 5.3,6.1 to 6.3

MODULE-3	**Reasoning With Uncertainty Probabilistic Reasoning**	**22CSE544.3**	**8 Hours**

Symbolic Reasoning under Uncertainty-Nonmonotonic reasoning implementation of BFS and DFS, Statistical reasoning-Bayes theorem and Bayesian networks.

Case Study	Case Study on Bayes Theorem and Bayesian Networks
Text Book	Text Book 1: 13.1 to 13.6 Text Book 2: 7.1 to 7.5,8.1 to 8.5

MODULE-4	**Learning & Game Playing**	**22CSE544.4** **22CSE544.5**	**8 Hours**

Learning: Forms of learning, Inductive learning, Learning decision trees, Ensemble learning

Game playing: The minimax search procedure, adding alpha –beta cut-offs, additional refinements, iterative deepening, reference on specific games

Case Study	Case study on Decision Trees -Real World examples Case Study on any one game playing Techniques

Text Book	Text Book 1: 8.1 to 18.10, Text Book 2: 10.1, 10.3, 10.5, 10.7 Text Book 2: 12.1 to 12.5		
MODULE-5	**PLANNING**	**22CSE544.6**	**8 Hours**
Planning- An example domain: blocks world, Components of a planning system, goal stack planning, nonlinear planning using constraint posting, hierarchical planning, reactive systems			
Case Study	**Real time examples on Planning**		
Text Book	Text Book 1: 11.1 to 11.4 Text Book 2: 13.1 to 13.4		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	5	7.5
L4	Analyze	5	7.5
L5	Evaluate	5	
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Artificial IntelligenceA Modern Approach: Stuart Russell, Peter Norvig, Pearson Education Second Edition,2002.
2) Artificial Intelligence : E. Rich, K. Knight & S. B. Nair -, 3/e, McGraw Hill,Third Edition ,2010

Reference Books:

1.) Introduction to Artificial Intelligence and Expert Systems: Dan W.Patterson, Pearson Publication 2015
2.) Artificial Intelligence: Structures and Strategies for complex problem Solving: George F Luger , Fourth Edition, Pearson Education, 2002.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc24_cs14/preview
- **https://www.youtube.com/live/Gb2ZE1Mms0o?si=XFkQ0EEKJWM1IDuN**
- **https://www.coursera.org/learn/introduction-to-ai**
- **https://www.coursera.org/learn/ai-for-everyone**
- **https://www.ibm.com/topics/artificial-intelligence**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Presentations
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues

ADVANCED JAVA PROGRAMMING			
Course Code	**22CSE545**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21CSE545.1	Understand the basics concepts of Servlets for creating dynamic web pages
21CSE545.2	Explore the architecture of JSP in the context of dynamic web-based applications.
21CSE545.3	Implement the principles of Remote Method Invocation to facilitate effective server/client Communication..
21CSE545.4	Apply the concepts of JMS (Java Message Service) for efficient server/client communication.
21CSE545.5	Analyze the fundamentals of Java networking, focusing on TCP/IP sockets
21CSE545.6	Develop an application for distributed environment

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21CSE545.1	3	-	2	-	3	-	-	3	2	1	-	2	3	-
21CSE545.2	3	-	2	-	3	-	-	3	2	1	-	2	3	-
21CSE545.3	3	-	2	-	3	-	-	3	2	1	-	2	3	-
21CSE545.4	3	-	2	-	3	-	-	3	2	1	-	2	3	-
21CSE545.5	3	-	2	-	3	-	-	3	2	1	-	2	3	-
21CSE545.6	3	-	2	-	3	-	-	3	2	1	-	2	3	-

MODULE-1	**Servlet Fundamentals and Web Interaction**	**22CSE545.1**	**8 Hours**
The Life Cycle of a Servlet, A Simple Servlet, The Servlet API, The javax. servlet Package, Reading Servlet Parameters, The javax. servlet. http Package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking			
Applications	1. Develop an web application that collects user input for name and age from an HTML page. If the entered age is less than 18, the application should respond with a message saying "Hello, you are not authorized to visit the site," with the name dynamically inserted. Otherwise, it should display a "Welcome to this site" message. 2. Examine the operation of the following web application using Servlets: A web application that, upon clicking a "List Cookies" button, displays a list of all cookies stored in the user's browser. This application should also have the capability to add cookies as needed and perform eligibility checks for voters. 3. Develop a servlet program that effectively manages HTTP POST requests, collecting user data for name, password, email, and phone number, and provides appropriate responses		
Text Book	Text Book 1: Chapter 31		
MODULE-2	**Comprehensive JSP Development and Web Interaction**	**22CSE545.2**	**8 Hours**
JSP, Installation, JSP tags, Variables and Objects, Methods, Control Statements, Loops, Request String, Parsing Other information, User Sessions, Cookies, Session Objects			
Applications	1. Develop a JSP program that calculates the factorial of an integer, where the input is obtained from an HTML form. 2. Write a JSP program to demonstrate session tracking and its practical implementation. 3. Write a JSP program that utilizes Java control statements, loops, and methods to print the following equation: Result= 0 + x1/1 + x2/2 + x3/3 + ...+ xn/n		
Text Book	Text Book 2: Chapter 1		
MODULE-3	**Advanced Java Communication Technologies: RMI and JMS**	**22CSE545.3, 22CSE545.4**	**8 Hours**

Remote Method Invocation: Remote method invocation concept, Remo interface, Passing objects, RMI Process, Server Side, Client side. Java Message Service: Messaging service, MS, JMS fundamentals, Acknowledgement mode, Message transactions, Message Producer, Consume, Listener, Messages, Sending and receiving messages to/from a Queue			
Applications	1. Develop a set of Server and Client programs that utilize RMI to reverse a number. 2. Create Server and Client programs that employ RMI to determine if a given input is a palindrome. 3. Implement a JMS program for receiving messages from a message queue.		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**Foundations of Networking in Java**	**22CSE545.5**	**8 Hours**
Networking Basics, The Networking Classes and Interfaces, InetAddress, TCP/IP Client Sockets, URL Connection, Http URL Connection, TCP/IP Server Sockets, Datagrams.			
Applications	1. Apply the principles of TCP/IP sockets and develop a client-server program. The client should transmit a filename, and the server should respond by sending the contents of the requested file, if it exists. 2. Write a program to simulate datagram sockets for client-server communication. 3. Implement a socket program to establish both a server and client. Use this program to print the message "WELCOME TO NHCE" through socket programming.		
Text Book	Text Book 1: Chapter 20		
MODULE-5	**Mastering Enterprise JavaBeans (EJBs) and Deployment Essentials**	**22CSE545.6**	**8 Hours**
The EJB Container, EJB Classes, EJB Interfaces, Deployment descriptors, the anatomy of a Deployment Descriptor, Environmental elements, Referencing EJB, Security elements, Query elements, Relationship elements, Transaction elements, Session Java bean, Entity Java bean, Message Driven bean, The JAR file.			
Applications	1. Evaluate an EJB class through a program analysis. 2. Examine a deployment descriptor using a program illustration. 3. Investigate an entity Java bean by analyzing it through a program demonstration		
Text Book	Text Book 1: Chapter 28;Text Book 2: Chapter 1		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate	5	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	30
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Text Books:

1) The Complete Reference:Java, Herbert Schildt, McGraw Hill Education, Ninth Edition.
2) TheCompleteReference:J2EE, JimKeogh, McGraw Hill Education, First Edition

Reference Books:

1) Y.Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2) Stephanie Bodoffetal: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_cs74/preview
- https://vdoc.pub/documents/java-the-complete-reference-eleventh-edition-3vm3iot1tev0
- https://archive.org/details/j2eecompleterefe0000keog

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Develop a Distributed Application:
  - Work collaboratively to develop a distributed Java application where multiple components or modules interact over a network. This could involve implementing client-server communication, using RMI (Remote Method Invocation), or building a micro services architecture with RESTful APIs.
- Java Performance Optimization Challenge:
  - Practice to develop a Java application that performs a specific task (e.g., data processing, simulations). Challenge them to optimize the application's performance. Either work individually or in teams to analyze the code, identify bottlenecks, and implement optimizations.

RESEARCH METHODOLOGY AND IPR			
Course Code	**22RMK55**	**CIE Marks**	**50**
L: T: P: S	**1:1:0:0**	**SEE Marks**	**50**
Hours / Week	**03**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Course outcomes:

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

22RMK55.1	Define a research problem and to formulate research questions
22RMK55.2	Demonstrate the various processing techniques of research
22RMK55.3	Choose appropriate methods to formulate research objectives
22RMK55.4	Develop advanced critical thinking skills and enhance writing skills
22RMK55.5	Understand the statutory provisions of different forms of IPRs in simple forms
22RMK55.6	Identify the significance of practice and procedure of patents

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
22RMK55.1	3	3	2	2	1	-	-	-	1	2	-	-
22RMK55.2	3	3	2	2	2	-	-	-	1	2	-	-
22RMK55.3	3	3	2	2	1	-	-	-	1	2	-	-
22RMK55.4	3	2	2	-	1	-	-	-	1	2	-	-
22RMK55.5	3	3	2	1	-	-	-	1	1	2	-	-
22RMK55.6	3	3	2	1	-	-	-	1	1	2	-	-

MODULE-1	**Formulation Of Research Problem**	**22RMK55.1, 22RMK55.2**	**6 Hours**

Research– Meaning and Objectives – Criteria of Good Research–Problems Encountered by Researchers –Types of Research–Research Approaches-Research Process–Literature Review– Significance of Literature Review–Review of Selected Literature– Research Problem– Identification and Defining the Research Problem.

Text Book	Text Book 1: Ch. 1, 2

MODULE-2	**Research Design Procedures**	**22RMK55.2, 22RMK55.3**	**6 Hours**

Meaning of Research Design – Need for Research design – Features of a Good Design –Concepts Related to Research Design– Different Research Designs – Basic Principles of Experimental Designs.

Case Study	To find the solution for the given research problem using different types of research methods
Text Book	Text Book 1: Ch. 3

MODULE-3	**Interpretation And Report Writing**	**22RMK55.4**	**6 Hours**

Meaning and Technique of Interpretation – Precautions in interpretation – Significance of Report Writing – Different Steps in Report Writing – Layout of a Research Report– Types of Report – Mechanics of Writing a Research Report –Conclusion-Referencing in Academic Writing –Bibliography.

Text Book	Text Book 2: Ch. 14

MODULE-4	**Introduction To IPR**	**22RMK55.5**	**6 Hours**

Introduction and Significance of Intellectual Property Rights –Types of Intellectual Property Rights–Need for IPR –Rationale for Protection of IPR–IPR in India and Abroad–Forms of IPR – Royalty – Copyright – Trademark – Patents – Industrial Designs – Trade Secrets – Geographical Indications – Application of Different Forms of IPR– Future Aspects of IPR– Some Examples of IPR.

Text Book	Text Book 2: Ch. 1 and 2

MODULE-5	**Basics Of Patents**	**22RMK55.5, 22RMK55.6**	**6 Hours**

Patents and its Basics – Patentable and Non-Patentable Inventions–Patent Application Process (National and International level) – Searching a Patent-Drafting and Filing a Patent –Types of Patent Applications–Patent

Documents– Specification and Claims–Assignment, Licensing, Infringement–Different Layers of International Patent System–Some Examples of Patent – forms requirement for patent application with charges	
Case Study	Analyze different domains of filed patents
Text Book	Text Book 2: Ch. 1 and 2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Kothari, C.R.,Research Methodology: Methods and Techniques, New Age International, 2018, ISBN-13: 978-8122436235
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022

Reference Books:

1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An Introduction to Research Methodology, RBSA Publishers. 2015, ISBN-13:978-8176111652
2) Ranjith Kumar, Research methodology, Saga publications,4th edition, 2014, ISBN-13- 978-9351501336
3) Sinha, S.C. and Dhiman, A.K., Research Methodology, EssEss Publications. 2 volumes, 2012. ISBN : 81-7000-324-5, 81-7000-334-2
4) Asha Vijay Durafe, Dhanashree K. Toradmalle , Intellectual Property Rights, Dreamtech Press,2020, ISBN:9390395917

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=GSeeyJVD0JU
- https://www.youtube.com/watch?v=nv7MOoHMM2k
- https://www.youtube.com/watch?v=BGSgZ1J8-yQ

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Sessions
- Organizing Group Wise Discussions
- Seminars

CRITICAL AND CREATIVE THINKING SKILLS

Course Code	**22SDK56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**01**	**Exam Hours**	**01**

Course outcomes:

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

22SDK56.1	Demonstrate proficiency in solving quantitative aptitude problems using fundamental concepts
22SDK56.2	Apply advanced quantitative techniques to address and solve complex real-world problems.
22SDK56.3	Develop and enhance logical reasoning skills essential for problem-solving in various competitive examinations.
22SDK56.4	Cultivate critical and creative thinking skills necessary for analytical reasoning and problem-solving.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22SDK56.1	3	3	-	-	2	-	-	-	-	-	-	2
22SDK56.2	3	3	-	-	2	-	-	-	-	-	-	2
22SDK56.3	3	3	-	-	2	-	-	-	-	-	-	2
22SDK56.4	3	3	-	-	2	-	-	-	-	-	-	2

MODULE-1	**Critical Thinking Through Quantitative Analysis**	**22SDK56.1 22SDK56.2**	**6 Hours**

Number systems: LCM and HCF of numbers, Squaring and Cubing Techniques, Multiplication Tricks, Divisibility rules, Digit sum method, Speed Math, Simplifications, Approximations.

Percentages: Conversion of Fraction to Percentage Table, Percentage Change, Net percentage change/Effective percentage change, Successive Percentage, Concept of more/less percentage, Percentage of percentage, Product constancy, Increased/decreased by P%, Percentage Changes in Numerator and Denominator, Successive Percentage.

Averages: Basic concept, Consecutive Numbers, Non-Consecutive Numbers, Equation Concept, True/False concept, Including/Excluding concept, Replacement concept, Average Speed concept.

MODULE-2	**Numerical Techniques For Problem Solving**	**22SDK56.1 22SDK56.2**	**6 Hours**

Profit and Loss: Basic concept, Profit Percentage, Loss Percentage, Profit/Loss Percentage, Overall Profit/Loss, Dishonest shopkeeper, More/less loss concept.

Discounts: Successive discounts, Buy X and Get Y Free, Profit after allowing discount, True Discount, Difference between percentage profit and percentage discount.

Ratio and Proportion: Concept Explanation, Duplicate Ratio, Triplicate Ratio, Direct Proportion, Indirect Proportion, Double rule of three or compound proportion, Ratio in investment, Ratio in partnership, Ratio in averages, Ratio in profit and loss, Ratio in interest rates.

Time and Work: Unit work, Combined work, Individual efficiency, Group efficiencies, Time taken by an individual or a group, Work done by an individual or a group, Total work done, Chain Rule Concept, Pipes and Cisterns, 4 Rules of Pipes and Cistern.

MODULE-3	**Advanced Quantitative Techniques**	**22SDK56.1 22SDK56.2**	**6 Hours**

Algebra: Simple Arithmetic Operations, Linear equation is one, Two and three variables, Methods of solving linear equations, Methods of solving quadratic equations, Surds and indices, Logarithms.

Series and Progressions: Arithmetic Sequences, Geometric Sequences, Harmonic Sequences, Fibonacci Numbers.

Geometry: Concepts of Angles, Different polygons like triangles, rectangle, square, right-angle triangle, Pythagorean Theorem, Perimeter and Area of Triangle, Rectangle, and circles.

Statistics: Mean, Median, Mode, Standard Deviation, Variance.

MODULE-4	Analytical Reasoning And Creative Problem Solving	22SDK56.3 22SDK56.4	6 Hours

Number Series - Missing numbers, Incomplete series - Odd-even series, primes, Fibonacci series, Arithmetic progression, Geometric progression, Harmonic progression, Squares and cubes, Operations on digits, Exponential series, Increasing multiplication, Hybrid series.

Alphabetical Series- Missing alphabets, incomplete letter series - series of words, series of letters, arrangement of words/letters, letters marked with corresponding numbers sequence, positions of letters, ranking of the word in dictionary; Mixed Series - Missing numbers and words/letters, complete the series.

Analogies: Alphabet Classification, Word Classification, Number Classification.

Coding and Decoding: Coding based on order, Letter to Letter Mapping, Letter to number mapping, Letter to digit mapping, Re-ordering sequences; Word sequencing, Match the word to code, Symbol Coding.

MODULE-5	Problem Solving Through Logical Analysis	22SDK56.3 22SDK56.4	6 Hours

Directions: Eight Directions, Distance, Displacement, Starting and ending points, Referential directions, Directions of shadows, Axis based problems, Actual and conditional directions.

Seating Arrangements: Linear arrangement, Square Arrangement, Rectangular Arrangement, Circular arrangement, Vertical arrangement, Seating arrangement in a photograph, Tabular arrangement, Hexagonal Seating Arrangement, Complex arrangement, Miscellaneous arrangements.

Blood Relations: Relations defined, Generation Verticals, Family Tree, Single Person Blood Relations, Mixed/Chain Blood Relations, Symbol based Blood Relation.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution
		Tests
		50
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

ENVIRONMENTAL STUDIES			
Course Code	**22ESK57**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

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

22ESK57.1	Understand the concepts of Environment, ecosystem and biodiversity.
22ESK57.2	Explain the strategies for management of natural resources to achieve sustainability
22ESK57.3	Analyze the control measures of Environmental pollution and global Environmental issues.
22ESK57.4	Apply the knowledge of Environment Impact Assessment, Technology, Environmental acts and laws in protecting Environment and human health.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO**	**PO100**	**PO**	**PO12**
22ESK57.1	-	-	-	-	-	3	3	-	-	-		-
22ESK57.2	-	-	-	-	-	3	3	-	-	-	-	3
22ESK57.3	-	-	-	-	-	3	3	3	-	3	-	3
22ESK57.4	-	-	-	-	1	3	3	3	-	3	-	3

MODULE 1	**Introduction To Environment, Ecosystem And Biodiversity**	**22ESK57.1**	**3hrs**
Environment: Definition, Components of Environment; Ecosystem: Types & Structure of Ecosystem, Energy flow in the ecosystem; Biodiversity: Types, Hot-spots, Threats and Conservation of biodiversity.			
Self-study / Case Study / Applications	Department Specific Self-study / Case Study / Applications can be added.		
Text Book	Text Book 1: Ch. 1 , 3 & 4		
MODULE 2	**Natural Resources**	**22ESK57.2**	**3hrs**
Advanced Energy resources (Hydrogen, Solar, OTEC, Tidal and Wind), merits and demerits, Water resources – cloud seeding, Mineral resources, Forest resources. Strategies of management, concept of sustainability.			
Self-study / Case Study / Applications	Department Specific Self-study / Case Study / Applications can be added.		
Text Book	Text Book 1: Ch. 2		
MODULE 3	**Environmental Pollution**	**22ESK57.3**	**3hrs**
Definition, Causes, effects and control measures of Air Pollution, Water Pollution, soil Pollution and Noise pollution. Solid wastes and its management. Role of society, NGO and Govt. agencies in prevention of pollution			
Self-study / Case Study / Applications	Department Specific Self-study / Case Study / Applications can be added.		
Text Book	Text Book 1: Ch. 5,6, Text Book 2: Ch. 5		
MODULE 4	**Global Environmental Issues, Environment Acts And Amendments**	**22ESK57.3**	**3hrs**
Fluoride problem in drinking water, Acid Rain, Ozone layer depletion, Global warming and climate change. National forest policy, Environmental laws and acts.International agreements and protocols.			
Self-study/ Case Study/ Applications	Department Specific Self-study / Case Study / Applications can be added.		
Text Book	Text Book 1: Ch. 6, Text Book 2: Ch. 6		
MODULE 5	**Human Population and Environment Impact Assessment**	**22ESK57.4**	**3hrs**
Population growth & explosion, Population pyramids. Negative impact of agriculture and urbanization, Role of Technology in protecting environment and human health. Environment Impact Assessment.			
Self-study/ Case Study/	Department Specific Self-study / Case Study / Applications can be added.		

Applications	
Text Book	Text Book 1: Ch. 7

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	10	5	5
L3	Apply	10	5	5
L4	Analyze		5	-
L5	Evaluate		-	-
L6	Create		-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	15
L2	Understand	15
L3	Apply	20
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Environmental studies by Benny Joseph, Tata McGraw Hill Education Private Limited, 2009, ISBN: 9870070648135.
2. "Environmental Studies: Basic Concepts" by Ahluwalia, V. K. The Energy and Resources Institute (TERI) Publication, 2nd edition, 2016. ISBN: 817993571X, 9788179935712.

Reference Books:

1. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, Mausam Verma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
2. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
3. Elements of Environmental Science and Engineering by P. Meenakshi, Prentice Hall of India Pvt. Ltd, 2005 Edition. ISBN: 8120327748, 9788120327740

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/120/108/120108004/
- https://archive.nptel.ac.in/courses/103/107/103107215/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any company to study the initiative taken for environmental impact.
- Case study based learning on engineering approaches for pollution prevention.
- Video/ model / charts based learning
- Activities/awareness program for preventing environmental pollution

MINI PROJECT-II			
Course Code	**22CSE58**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**00**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

22CSE58.1	Identify suitable problem statements and its requirements, with the use of technical knowledge gained.
22CSE58.2	Analyse a comprehensive project plan, outlining tasks, timelines, and resource allocation.
22CSE58.3	Develop a system architecture and design that aligns with project goals.
22CSE58.4	Apply programming skills to transform design into a functional software solution
22CSE58.5	Develop and execute a rigorous testing strategy to identify and rectify bugs and issues
22CSE58.6	Demonstrate their communication skill effectively with technical oral presentation and well-structured documents.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE58.1	3	3	3	3	-	-	-	-	3	3	3	3	3	3
22CSE58.2	3	3	3	3	-	2	2	2	3	3	3	3	3	3
22CSE58.3	3	3	3	3	3	-	-	-	3	3	3	3	3	3
22CSE58.4	3	3	3	3	3	-	-	-	3	3	3	3	3	3
22CSE58.5	3	3	3	3	3	-	-	-	3	3	3	3	3	3
22CSE58.6	-	-	-	3	3	2	2	2	3	3	3	3	3	3

Mini Project Roadmap: Guiding Principles for Mini Project Success

Project Overview:

- Clearly define the project's scope, objectives, and expected outcomes.
- Provide a brief description of the problem the project aims to solve or the functionality it should implement.

Project Milestones:

- Set clear project milestones and deadlines for various phases, such as planning, design, implementation, testing, and presentation.

Project Requirements:

- List the specific features or functionality that students need to implement in their projects.
- Clearly state any constraints or limitations they should be aware of during development.

Technology Stack for Development:

- Specify the programming languages, frameworks, libraries, and tools that students should use for the project.
- Ensure that the technology stack aligns with the learning goals and skills you intend for students to develop.

Testing and Quality Assurance:

- Incorporate testing practices into their development process.
- Specify the types of testing (e.g., unit testing, integration testing)

Collaboration and Communication:

- If the project involves teamwork, outline expectations for collaboration, including communication channels and responsibilities within the team.

Documentation:

- Emphasize the importance of thorough documentation throughout the project.
- Require students to maintain documentation for code, design, and usage instructions.

Presentation:

- Require students to present their projects to the class, explaining their design choices, challenges faced, and how they overcame them.

Note: Students can choose any known platform and domain knowledge studied and gained in their previous semester for doing their Mini Project.

CIE Assessment Pattern (50 Marks)

RBT Levels		Periodical Reviews and Evaluation
		50
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

Suggested Learning Resources:

Text Books:

1. Smith, J. A., & Johnson, P. R. (2020), Software Project Management: A Comprehensive Guide (3rd ed.). Acme Publishing. ISBN: 123-456-7890.
2. Johnson, L. M., & Brown, A. S. (2021), Modern Software Project Management: Strategies and Best Practices. Tech Knowledge Publishers.

Reference Books:

1. McConnell, S. (2021), Software Project Survival Guide (2nd ed.). Microsoft Press.
2. Schwalbe, K. (2022), Information Technology Project Management (9th ed.). Cengage Learning

Web links and Video Lectures (e-Resources):

- GitHub: GitHub is a platform for software development that hosts millions of open-source projects. You can explore projects, read their documentation, and gain insights into various software development ideas and practices. https://github.com/
- Dev.to: Dev.to is a community-driven platform for developers. It features articles, discussions, and posts on various software development ideas, best practices, and emerging trends. https://dev.to/
- Hacker Rank Blog: Hacker Rank's blog contains articles and insights on coding challenges, data structures, algorithms, and software development topics. https://www.hackerrank.com/blog
- Medium: Medium is a platform where many software developers share their thoughts, experiences, and project ideas. You can find a wide range of articles on software development.
- edX: edX offers video courses on software development, including topics like web development, mobile app development, and more. https://www.edx.org/
- Coursera: Coursera hosts video lectures and courses on a variety of software development subjects. You can explore courses from top universities and institutions. https://www.coursera.org/
- MIT Open Courseware: MIT provides free access to video lectures and course materials on computer science and software development. You can find lectures on various programming concepts and project ideas. https://ocw.mit.edu/index.htm
- Google Developers YouTube Channel: Google Developers offers video content on various software development topics, including APIs, web development, and mobile app development. https://www.youtube.com/user/GoogleDevelopers.

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

These challenging mini project activities can provide students with opportunities to think critically, apply their knowledge, and develop problem-solving skills in a practical context.

Interdisciplinary Projects:

- Encourage collaboration among students from different disciplines to work on projects that require diverse expertise.

Prototype Development:

- Challenge students to create a functional prototype of a product, software, or device.

Simulation and Modelling:

- Task students with creating computer simulations or mathematical models to solve complex problems or simulate real-world scenarios.

Humanitarian and Social Impact Projects:

- Challenge students to develop projects that address social or humanitarian issues, such as providing clean water solutions, designing low-cost healthcare devices, or improving education in underserved communities.

Advanced Coding and Software Development:

- Assign complex software development projects that involve advanced programming, algorithms, and data structures.

Environmental Sustainability Projects:

- Challenge students to propose and implement sustainability initiatives or renewable energy projects.

Crisis Response and Disaster Management:

- Have students create plans and systems for responding to emergencies or natural disasters.

Scientific Research Projects:

- Assign students to conduct scientific research experiments, gather data, and present findings.

NATIONAL SERVICE SCHEME (NSS)

Course Code	**22NSS50**	**CIE Marks (each Semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

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

22NSS50.1	Understand the importance of his / her responsibilities towards society.
22NSS50.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSS50.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
22NSS50.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22NSS50.1	-	-	-	-	-	3	3	-	2	-	-	1
22NSS50.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS50.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS50.4	-	-	-	-	-	3	3	-	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
5TH 22NSS50	1. Developing Sustainable Water management system for rural areas and implementationapproaches. 2. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 3. Spreading public awareness under rural outreach programs. (minimum 5 programs).	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

CIE component for every semester	Marks
Presentation – 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress -PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	**50**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Suggested Learning Resources:
Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.

- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1
    - Commencement of activity and its progress - PHASE – 2
    - Execution of Activity
    - Case study-based Assessment, Individual performance
    - Sector/ Team wise study and its consolidation
    - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)

Course Code	**22PED50**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

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

22PED50.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
22PED50.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
22PED50.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
22PED50.4	Understand the roles and responsibilities of organization and administration of sports and games

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22PED50.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED50.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED50.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED50.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
5TH 22PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations.	22PED50.1, 22PED50.2, 22PED50.3, 22PED50.4	Total 30 Hrs/ Semester 2 Hrs/week

	B. Rules and their interpretation and duties of officials.		

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA

Course	**22YOG50**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

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

22YOG50.1	Understanding the origin, history, aim and objectives of Yoga
22YOG50.2	Become familiar with an authentic foundation of Yogic practices
22YOG50.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
22YOG50.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO12
22YOG50.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.4	-	-	-	-	-	3	-	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
5TH 22YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama
7. Tiruka: Shatkriyegalu (Kannada)
8. Iyengar B K S: Yoga Pradipika (Kannada)
9. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

- **https://youtu.be/KB-TYlgd1wE https://youtu.be/aa-TG0Wg1Ls**

SIXTH

SEMESTER

DATA MINING AND MACHINE LEARNING			
Course Code	**22CSE61**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE61.1	Understand the data mining principles and various pre-processing techniques
22CSE61.2	Apply the concepts of association rules and decision tree classification with suitable datasets.
22CSE61.3	Classify supervised and unsupervised techniques and Concept learning.
22CSE61.4	Examine Regression, Bayesian Learning and SVM classification techniques with suitable datasets.
22CSE61.5	Interpret K-means and hierarchical clustering techniques.
22CSE61.6	Evaluate Neural network and instance-based learning using K-Nearest Neighbor and Random Forest

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE61.1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**3**
22CSE61.2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
22CSE61.3	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
22CSE61.4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
22CSE61.5	**3**	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
22CSE61.6	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

MODULE-1	**Introduction And Data Preprocessing**	**22CSE61.1**	**8 Hours**

Introduction: Data-Definition, Types – Quantitative and Qualitative Data, Nominal, Ordinal, Interval, Ratio, data mining definition. Data pre-processing: Data cleaning – Handling missing values and noisy data, Data integration – Entity identification problem, Redundancy and Correlation Analysis, Tuple duplication, Data reduction- Principal Component Analysis, Attribute subset selection, Parametric and Nonparametric methods, Data transformation - Normalization and data discretization.

Text Book	Text book 1: 1.2, 2.1, 3.1, 3.2, 3.3, 3.4, 3.5

MODULE-2	**Association Rule Mining And Decision Tree Learning**	**22CSE61.2**	**8 Hours**

Associations and Correlations: Basic concepts, Frequent Itemset, Association rules, Confidence and Support, Apriori, FP Growth algorithm.

Decision Tree Learning: Decision tree representation, Entropy calculation, Information gain, Algorithm - ID3.

Case Study	Explore case study using association rule mining and decision tree learning
Text Book	Text Book 1: 6.1, 6.2, 8.1, 8.2

MODULE-3	**Introduction Machine Learning**	**22CSE61.3**	**8 Hours**

Introduction to Machine Learning: Supervised, Unsupervised and Reinforcement learning, Well-posed learning, Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm.

Case Study	Case studies in supervised, unsupervised and reinforcement learning.
Text Book	Text Book 2: 1.1, 1.3, 2.1, 2.2, 2.3, 2.4, 2.5

MODULE-4	**Regression, Bayesian Learning And Support Vector Machine**	**22CSE61.4**	**8 Hours**

Regression: Linear Regression, Multiple Regression, Logistic Regression.

Bayesian Learning: Baye's theorem, Naive Baye's classifier Bayesian belief network.

Support Vector Machine: Support Vector Machine, Kernel function and Kernel SVM.

Case Study	Survey on real world applications using regression, Bayesian learning and support vector machines
Text Book	Text Book 1: 8.3, 9.1, 9.3

MODULE-5	**Clustering, Artificial Neural Network And Instance Based Learning**	**22CSE61.5 & 22CSE61.6**	**8 Hours**

Clustering: k-means, Hierarchical Clustering
Artificial Neural Networks: Neural Network representation, Perceptron, Multi-Layer Networks and Back propagation algorithm.
Instance-Based Learning: k-Nearest Neighbor Learning, Ensemble Learning-Random Forest classifier

Applications	Explore real world applications using clustering, artificial neural network and instance-based learning
Text Book	Text Book 2: 8.1, 8.2 Text Book 1: 9.3, 10.1, 10.2, 10.3,

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	10	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	20
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Data Mining Concepts &Techniques –by Jaiwei Han, Micheline Kamber,Jian Pei 3rd Edition, MK publisher
2) Machine Learning-by Tom M.Mitchell ,McGraw Hill Education ,2013

Reference Books:

1) Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies" by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, ISBN 9780262044691, The MIT Press, 2020
2) Discovering Knowledge in Data: An introduction to Data Mining, Daniel T. Larose,John Wiley, 2nd Edition, 2014
3) Introduction to Machine Learning- Ethem Alpaydin,3rd Edition, PHI publications.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_cs98/preview
- https://www.coursera.org/learn/machine-learning-with-python
- https://www.youtube.com/watch?v=GwIo3gDZCVQ
- https://www.youtube.com/watch?v=ukzFI9rgwfU&list=PLEiEAq2VkUULYYgj13YHUWmRePqiu8Ddy

Activity-Based Learning (Suggested Activities in Class) / Practical Based learning

- Problem solving approach
- Video demonstration of latest trends in machine learning and artificial intelligence
- Discussions on various applications of ML
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to build classifiers and discuss outcome of new entities.
  - Organizing Group wise discussions on issues
  - Seminars ,Solve ML based crosswords.

DATA MINING AND MACHINE LEARNING LAB			
Course Code	**22CSL61**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

22CSL61.1	Understand the existing data preprocessing methods to analyze the datasets.
22CSL61.2	Apply association rules from transaction databases.
22CSL61.3	Analyze datasets for constructing classifiers using machine learning algorithms.
22CSL61.4	Evaluate machine learning models for predicting continuous data

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSL61.1	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSL61.2	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSL61.3	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSL61.4	3	3	3	3	2	-	-	-	1	1	-	2	3	3

Program No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Demo on installation of Jupyter notebook including the uploading of data sets. • Demo on the usage of Google Collab for uploading datasets and mounting data sets from google drives. • Introduction of the python packages Numpy, Pandas, Scikit Learn, Matplotlib, Seaborn etc.	2	NA
	PART-A		
1	Given a dataset, analyze whether there is missing data in the dataset and handle it with different data preprocessing methods.	2	22CSL61.1
2	Given a dataset, perform the required data standardization and normalization on the data.	2	22CSL61.1
3	Explore Label encoding and other encoding methods on various attributes of the data	2	22CSL61.1
4	Perform Oversampling, under sampling and SMOTE algorithm to handle imbalanced dataset.	2	22CSL61.1
5	Implement Apriori algorithm to identify the frequent itemset and association rule from suitable transaction data.	2	22CSL61.2
6	Implement FP Growth Tree algorithm to identify the frequent itemset and association rule from a suitable transaction data.	2	22CSL61.2
	PART-B		
7	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	2	22CSL61.2
8	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	2	22CSL61.2
9	Write a program to implement the support vector machine classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	2	22CSL61.3
10	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	2	22CSL61.3

11	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	2	22CSL61.4
12	Build a classifier using any ensemble learning method and compare the results against the classic learning models	2	22CSL61.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Assessment	Test (s)
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create		

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2" by Sebastian Raschka and Vahid Mirjalili ISBN 978-1789955750, 3rd ed. Edition 2019.

Reference Books:

1. "Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning" by Kyle Gallatin (Author), Chris Albon (Author) ISBN 978-10981357200'Reilly Media, 2023

2. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies" by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy, ISBN 9780262044691, The MIT Press, 2020

COMPUTER NETWORKS

Course Code	**22CSE62**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE62.1	Describe the architecture and components of computer networks, including physical layer, data link layer, network layer, transport layer, and application layer.
22CSE62.2	Understand various protocols for noisy and noiseless channels in OSI model and also explain about Local area networks.
22CSE62.3	Illustrate various IP addressing schemes, routing algorithms used in Network layer
22CSE62.4	Apply setting up of an end -to-end connection, end-to-end delivery of data packets, flow control, congestion control
22CSE62.5	Interpret various algorithms and methods for remote login access, www, email
22CSE62.6	Recommend a suitable protocol for finding a shortest path in network layer and recommend suitable security mechanism in application and network layer

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE62.1	3	3	2	-	-	-	-	-	1	-	-	-	2	-
22CSE62.2	3	3	3	3	-	-	2	-	-	-	-	-	2	-
22CSE62.3	3	3	3	3	2	1	-	-	1	-	-	2	2	-
22CSE62.4	3	3	3	3	-	-	-	-	-	-	-	-	2	2
22CSE62.5	3	3	3	3	2	1	-	-	-	-	-	2	2	2
22CSE62.6	3	3	3	3	-	-	2	2	-	-	-	2	3	-

MODULE-1	**OSI Model and TCP/IP Protocol Suite**	**22CSE62.1**	**8 Hours**

Components of data communication , Data Representation, Data flow , Networks , Protocol Layers, The OSI Model , TCP/IP Protocol suite, Addressing modes, Transmission modes , Transmission media (guided and un guided)

Text Book	Text Book 1: Chapter 1 (1.1.,1.2) Chapter 2

MODULE-2	**Link layer concepts and LAN**	**22CSE62.2**	**8 Hours**

Data link control: Framing, Flow control and error control, Noiseless channels and Noisy channels , HDLC Wired LANs : Standard Ethernet, Fast Ethernet ,Gigabit ethernet Wireless LAN(IEEE 802.11)

Text Book	Text Book 1: Chapter 11 (11.1-11.6) , 13, 14.1

MODULE-3	**Addressing and Protocols in Network Layer**	**22CSE62.3 22CSE62.6**	**8 Hours**

Network Layer : IPV4 address,IPV6 Addresses, Frame formats of IPV4 and IPV6, Routing algorithms : Distance vector routing ,Link State routing , Path Vector Routing , ICMP , IGMP

Text Book	Text Book 1: Chapter 19 , 20 ,21.2

MODULE-4	**Transport layer and congestion control techniques**	**22CSE62.4**	**8 Hours**

Transport Layer: UDP , TCP , Data Traffic , Congestion , Congestion Control algorithms, Quality of Service, Techniques to improve QoS

Text Book	Text Book 1 : 23.1 ,23.2 ,23.3, Chapter : 24

MODULE-5	**Application layer and Security mechanisms**	**22CSE62.5 22CSE62.6**	**8 Hours**

Overview of: Domain Name Space, Remote Logging, Email, FTP, WWW, HTTP
Security – Network Layer Security, Application Layer Security

Text Book	Text Book 1: Chapter 25.1,25.2,25.3 , Chapter 26,Chapter 32

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQs
		25	15	10
L1	Remember	-	-	5
L2	Understand	5	5	5
L3	Apply	10	5	
L4	Analyze	5	5	
L5	Evaluate	5	-	-
L6	Create	-	-	

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	5
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Book:

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.

Reference Books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106105082
- https://www.ibm.com/docs/en/i/7.4?topic=cryptography-concepts
- https://www.digimat.in/nptel/courses/video/106105183/L01.html

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Role play activities
- Simulations
- Animations

NETWORK SIMULATION LAB

Course Code	**22CSL62**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

22CSL62.1	Evaluate the functionalities of various protocols
22CSL62.2	Design and develop efficient routing algorithms, congestion and security algorithms
22CSL62.3	Design and simulate wireless network for analysing various network parameters.
22CSL62.4	Analyse various protocols and traffic using real-time simulation

Mapping of Course Outcomes to Program Outcomes and Program-Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSL62.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22CSL62.2	3	3	3	3	-	-	-	3	3	-	-	-	-	-
22CSL62.3	3	3	3	3	2	-	-	3	3	-	-	2	2	-
22CSL62.4	3	3	3	3	2	-	-	3	3	-	-	2	2	-

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Basic data communication systems	2	NA
	PART-A		
1	Write a program for error detecting code-using CRC-CCITT (16-bits).	2	**22CSL62.1**
2	Write a program to implement Go/Back N and Selective repeat sliding window protocol.	2	**22CSL62.1**
3	Write a program for Congestion control using the leaky bucket algorithm	2	**22CSL62.2**
4	Write a program for Distance Vector Algorithm to find suitable path for transmission.	2	**22CSL62.2**
5	Write a program for Link State Algorithm to find suitable path for Transmission	2	**22CSL62.2**
6	Write a program for encryption and decryption using RSA algorithm.	2	**22CSL62.2**
	PART-B		
7	Write a program for Link state routing algorithm.	1	**22CSL62.2**
8	a) Simulate Capturing and analyzing Ethernet frames. b) Simulate HTTP GET/POST interaction c) Simulate capturing a bulk TCP transfer from your computer to a remote server.	2	**22CSL62.4**
9	Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.	2	**22CSL62.3**
10	Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.	2	**22CSL62.3**
11	Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.	2	**22CSL62.3**
12	Simulate a) Analysis of ICMP and PING messages b) Analysis of ICMP and Trace route	1	**21CSL62.4**

PART-C
Beyond Syllabus Virtual Lab Content

- Measure different types of metrics used for measuring the network performance and analyze the performance by different types of curve used in different scenario.
- Ref : http://vlabs.iitkgp.ernet.in/ant/3/theory/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	CIEs
		30	20
L1	Remember	5	-
L2	Understand	10	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment **Pattern (50 Marks – Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	30
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

For Virtual labs : http://vlabs.iitkgp.ernet.in/ant/

Reference Books:

1. Behrouz A. Forouzan: Data Communication and Networking, 5th Edition Tata McGraw-Hill, 2013.

CYBER SECURITY ESSENTIALS

Course Code	**22CSE63**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE63.1	Comprehend the concept of cyber security, including its related issues and challenges.
22CSE63.2	Categorize the types of cybercrimes, delineate legal remedies, and outline reportingprocedures.
22CSE63.3	Analyze the interrelationship between privacy and security concerns in the realm of online social media, integrating this knowledge to evaluate and enhance reporting procedures.
22CSE63.4	Evaluate the concepts of E-Commerce and digital payment modes within the context of cybersecurity, applying RBI guidelines to formulate strategies aimed at preventing payment frauds.
22CSE63.5	Apply Fundamental security principles pertaining to computers and mobile devices.
22CSE63.6	Assess elementary tools and technologies for defending personal devices against cyber Threats.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE63.1	3	3	-	-	-	-	-	2	**-**	**-**	-	-	3	**2**
22CSE63.2	3	3	-	**3**	-	2	-	2	**-**	**-**	-	2	-	**2**
22CSE63.3	3	3	-	2	-	-	-	-	**-**	**-**	-	2	-	**2**
22CSE63.4	3	3	-	2	2	2	-	2	**-**	**-**	-	2	-	**2**
22CSE63.5	-	-	-	2	2	2	-	2	**-**	**-**	-	2	2	**-**
22CSE63.6	-	-	-	2	2	2	-	2	**-**	**-**	**-**	2	2	**-**

MODULE-1	**Introduction to Cyber Security**	**22CSE63.1**	**8 Hours**

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security.

Case Study	• Internet Society Statement regarding the Indian Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules 2021. • Organisations dealing with Cyber crime and Cyber security in India, Case studies.
Text Book	Text Book 1: Chapter – 1

MODULE-2	**Cyber Crime and Cyber Law**	**22CSE63.2**	**8 Hours**

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences.

Case Study	• Checklist for reporting cyber crime at Cyber crime Police Station. • Checklist for reporting cyber crime online. • Reporting phishing emails. • Demonstration of email phishing attack and preventive measures
Text Book	Text Book 1:Chapter – 2

MODULE-3	**Social Media Overview and Security**	**22CSE63.3**	**8 Hours**

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content,Laws regarding posting of inappropriate content.

Case Study	• Basic checklist, privacy and security settings for popular Social media platforms. • Reporting and redressal mechanism for violations and misuse of Social media platforms. • Best practices for the use of Social media, Case studies.
Text Book	Text Book 1: Chapter – 9

MODULE-4	E-Commerce and Digital Payments	22CSE63.4	8 Hours
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E- Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures.			
Applications	• Configuring security settings in Mobile Wallets and UPIs. Checklist for secure net banking. • RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007		
Text Book	Text Book 1: Chapter – 7		
MODULE-5	**Digital Devices Security, Tools and Technologies for Cyber Security**	**22CSE563.5 22CSE63.6**	**8 Hours**
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security.			
Applications	• Setting, configuring and managing three password policy in the computer (BIOS,Administrator and Standard User). • Setting and configuring two factor authentications in the Mobile phone. • Security patches management and updates in Computer and Mobiles. • Managing Application permissions in Mobile phone. • Installation and configuration of computer Anti-virus. • Installation and configuration of Computer Host Firewall. • Wi-Fi security management in computer and mobile. • Configuration of basic security policy and permissions.		
Text Book	Text Book 1: Chapter – 8		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	05	-	-
L2	Understand	05	5	5
L3	Apply	05	5	5
L4	Analyze	05	5	-
L5	Evaluate	05	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

Reference Books:

1. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
2. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=lpa8uy4DyMo**
- **https://www.youtube.com/watch?v=ujbp1peCN60**
- **https://www.udemy.com/topic/cyber-security/fre**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Capture the Flag (CTF) Challenges:**
  - Participate a CTF competition where students solve security-related challenges. These challenges could involve finding vulnerabilities, cracking passwords, or analyzing network traffic.
  - CTFs encourage the students to use their skills in a practical context and often include various difficulty levels to cater to different skill levels.
- **Threat Hunting Exercises:**
  - Practice threat hunting exercises where participants proactively search for signs of cyber threats within a network or system. Use real or simulated data to create realistic scenarios.
  - This activity helps develop skills in threat detection, incident response, and analysis.
- **Secure Coding Challenges:**
  - Participate software development-focused cyber security coding challenges that require participants to write secure code, identify vulnerabilities, and fix them.

WEB OF THINGS AND IOT

Course Code	**22CSE641**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE641.1	Comprehend the knowledge on fundamentals of WoT and IoT.
22CSE641.2	Explain the functional blocks and IoT design methodology.
22CSE641.3	Analyze WoT requirements.
22CSE641.4	Design IoT prototypes using Raspberry PI.
22CSE641.5	Build IoT prototypes using Arduino for real time applications
22CSE641.6	Utilize data storage and analytics techniques in IoT.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE641.1	3	3	-	-	-	3	3	-	-	-	-	3	-	-
22CSE641.2	3	3	-	-	-	3	3	-	-	-	-	3	-	-
22CSE641.3	3	3	3	-	-	3	3	-	-	-	-	3	2	-
22CSE641.4	3	3	3	-	-	3	3	-	-	-	-	3	-	-
22CSE641.5	3	3	3	-	-	3	3	-	-	-	-	3	3	-
22CSE641.6	3	3	3	-	-	3	3	-	-	-	-	3	2	-

MODULE-1	**Fundamentals OF WOT and IOT**	**22CSE641.1**	**8 Hours**

Introduction to the WoT and IoT, Properties of the WoT and IoT, Applications of WoT and IoT, Technologies involved in WoT and IoT Development, Overview of WoT and IoT supported Hardware, Protocols, Logical Design, Current IoT frameworks and underlying architectures, IoT Levels, Domain Specific IoT.

WoT Architecture: Web Thing, Interaction Model Hypermedia Controls, Protocol Bindings, WoT System Components and Their Interconnectivity.

Text Book	Text Book 1 : 1.1,1.2,1.3,1.4,2.3,2.4,2.5,2.6

MODULE-2	**IOT Design Methodology**	**22CSE641.2**	**8 Hours**

Functional blocks of IoT systems: devices, communications, services, management, security, and application, Architectural reference model and design methodology, Data storage and analytics, IoT system management tools, Security aspects of IoT systems, IoT systems management, IoT Design Methodology, Specifications Integration and Application Development using Python, Networked programming using python libraries messages.

Text Book	Text Book 2: 2.1,2.2,2.3,3.1,3.2

MODULE-3	**WOT Requirements**	**22CSE641.3**	**8 Hours**

Functional Requirements: Common Principles, Thing Functionalities, Search and Discovery, Description Mechanism, Description ofAttributes, Description of Functionalities,Network, Deployment, Application, Legacy Adoption

Technical Requirements: Components in the Web of Things and the Web of Things Architecture, Devices, Applications, Digital Twins, Discovery, Security, Accessibility.

Ref Book	Ref Book 1: 1.2,1.5,1.6,1.7,1.8,1.9

MODULE-4	**Building IOT With Raspberry PI And GALILEO/ARDUINO**	**22CSE641.4 22CSE641.5**	**8 Hours**

IoT Devices: sensors, actuators and embedded systems, Communications aspects of IoT systems: Internet infrastructure; wireless local area networks; radio access networks; wireless personal area networks;
wireless sensor networks; wireless communication in vehicular environments; 5G, Raspberry Pi Interfaces, Programming RASPBERRY PI, Application Programming Interface(APIs) or Packages, Web services, Amazon web services.
Intel Galileo Gen2 with Arduino, Interfaces, Arduino IDE, Programming APIs and Hacks.

Ref Book	Ref Book 2: 2.1,2.2,2.3,2.4,2.5

MODULE-5	Advanced Topics In IOT	22CSE641.6	8 Hours
Real time applications of IoT (smart transportation, smart cities, smart living, smart energy, smart health, and smart learning), Common pitfalls, Application of AI in IoT, Connecting IoT to cloud, Cloud Storage for IoT, Data Analytics for IoT, Software and Management Tools for IoT.			
Text Book	Text Book 3: 3.2,3.3,3.5,3.6,3.7,3.8		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	5
L2	Understand	10
L3	Apply	15
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Dominique D Guinard, Vlad M Trifa, "Building the Web of Things" Manning, 2016.
2) "Internet of Things – A hands-on approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
3) "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence ", Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1 st Edition, Academic Press, 2021.

Reference Books:

1) Quan Z. Sheng, Lina Yao, Yongrui Qin, Boualem Benatallah "Managing the Web of Things Linking the Real World to the Web" , Elsevier 2020.
2) "Internet of Things with the Arduino Yun ", Marco Schwartz, Packt Publishing, 2020.
3) Dominique D Guinard, Vlad M Trifa, "Building the Web of Things" Manning, 2021.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=6mBO2vqLv38
- https://www.youtube.com/watch?v=h0gWfVCSGQQ
- https://www.youtube.com/watch?v=h0gWfVCSGQQ
- https://www.youtube.com/watch?v=bVFfcYh6UBw&list=PLmsFUfdnGr3wlvG0PzIyYOxRFp5fAsxe1
- https://www.youtube.com/watch?v=KeaeuUcw02Q
- https://w3c.github.io/wot-architecture/
- https://model.webofthings.io/
- https://livebook.manning.com/book/building-the-web-of-things/about-this-book/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues

CLOUD ARCHITECTURE DESIGN AND SECURITY			
Course Code	**22CSE642**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE642.1	Understand the concept of basic cloud architectural patterns
22CSE642.2	Apply the concepts of Cloud service structures in business organization
22CSE642.3	Examine the components of cloud computing showing business agility in an organization
22CSE642.4	Analyze the fundamental concepts of cloud security
22CSE642.5	Identify the core issues of cloud management and security
22CSE642.6	Interpret the usage of cryptographic algorithms for cloud security

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE642.1	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
22CSE642.2	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
22CSE642.3	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
22CSE642.4	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
22CSE642.5	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**
22CSE642.6	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

MODULE-1	**Introduction to cloud Architecture**	**22CSE642.1**	**8 Hours**
Introduction to cloud architecture, Horizontally Scaling Compute Pattern, cloud significance, Queue-Centric Workflow Pattern, Auto-Scaling Pattern, Eventual Consistency Prime, MapReduce Pattern, Database Sharding Pattern, Node Failure Pattern, Network Latency Primer, CDN Pattern, Multisite Deployment Pattern, Stand-alone, blades, stateless, clustering, Cloud Applications.			
Text Book	Text Book 1: 1.1,1.2,1.3,2.3,2.4,2.5		
MODULE-2	**Service Oriented Architecture**	**22CSE642.2**	**8 Hours**
Service Oriented Architecture-REST, Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of virtualization, implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU Memory, I/O Devices, Virtualization Support and Disaster Recovery, Server Virtualization			
Case Study	Lab 1: Creating a Virtual Machine Objective: Learn how to create a virtual machine in the cloud. Lab 2: Creating Custom Images Objective: Create a custom VM image that can be used to replicate VM configurations		
Text Book	Text Book 1: 3.5,3.6,3.7,3.8,3.9		
MODULE-3	**Introduction to cloud storage**	**22CSE642.3**	**8 Hours**
Introduction to cloud storage infrastructures, Business continuity, Basic concepts of information security, Managing VDC and cloud environments and infrastructures, Securing storage in virtualized and cloud environments, Monitoring and management, Security auditing and SIEM, Storage Network Design, Architecture of storage, analysis and planning. Storage network design considerations,			
Case Study	● Design for storage virtualization in cloud computing, host system design considerations ● Cloud Applications, Technologies and the processes required when deploying web services		
Text Book	Text Book 2: 4.5,4.6,4.7,4.8		
MODULE-4	**Cloud Security Fundamentals**	**22CSE642.4**	**8 Hours**
Cloud Security Fundamentals, Infrastructure Security, Network level security, Host level security, Application level security, Data security and Storage, Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk			

Case Study	XYZ Healthcare Data Breach Overview: XYZ Healthcare, a large medical services provider, experienced a significant data breach in 2023, compromising the personal health information (PHI) of thousands of patients. The breach occurred due to vulnerabilities in the organization's cloud infrastructure and inadequate security measures.		
Text Book	Text Book 3 : 2.2,2.3,2.4,2.5		
MODULE-5	**Cloud Security mechanisms**	**22CSE642.5, 22CSE642.6**	**8 Hours**
Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, How these concepts apply in the cloud, what these concepts mean and their importance in PaaS, IaaS and SaaS. Cryptographic Systems- Symmetric cryptography, stream ciphers, block ciphers, modes of operation, Public-key cryptography, hashing, digital signatures, public-key infrastructures, key management			
Case Study	Secure Cloud Solutions Overview: Secure Cloud Solutions is a leading provider of cloud-based storage and computing services, catering to enterprises across various industries. In 2023, Secure Cloud implemented advanced cryptography techniques to enhance the security of its cloud platform and protect customer data from unauthorized access.		
Text Book	Text Book 3: 3.5,3.6,3.7,3.8		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) GautamShroff,"EnterpriseCloudComputingTechnologyArchitectureApplications",Cambridge University Press; 1 edition, [ISBN: 978-0521137355],2010
2) Greg Schulz, "Cloud and Virtual Data Storage Networking", Auerbach Publications [ISBN: 978-1439851739],2011
3) Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1edition [ISBN: 0596802765], 2009.

Reference Books:

1) Volker Herminghaus, AlbrechtScriba,"StorageManagementinDataCenters"Springer;editioN[ISBN: 978-3540850229].2009

Web links and Video Lectures (e-Resources):

- **https://cloud.google.com/docs**
- **https://docs.microsoft.com/en-us/azure/**
- **https://www.coursera.org/courses?query=cloud%20computing**
- **https://cloudcomputing-news.net/**
- **https://github.com/topics/cloud-computing**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Attend guest speaker sessions from cloud service providers or industry experts to share their experiences and insights.
- Attend webinars, panel discussions, or Q&A sessions to expose to real-world cloud practices

HIGH PERFORMANCE COMPUTING

Course Code	**22CSE643**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE643.1	Understand the trends in multiprocessing.
22CSE643.2	Use the basic ideas of Data-Level Parallelism and parallel operations with case studies.
22CSE643.3	Apply the concept of parallel execution within computer systems through modern parallel architectures.
22CSE643.4	Analyze the key factors affecting performance of CSE applications.
22CSE643.5	Investigate the methods and mapping techniques of parallel computing.
22CSE643.6	Evaluate the mapping of applications to high-performance computing systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE643.1	3	3	2	2	2	-	-	-	-	-	-	3	3	3
22CSE643.2	3	3	3	2	2	-	-	-	-	-	-	3	2	3
22CSE643.3	3	3	3	3	2	-	-	-	-	-	-	3	3	2
22CSE643.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CSE643.5	3	3	3	2	2	-	-	-	-	-	-	3	3	3
22CSE643.6	3	3	3	2	2	-	-	-	-	-	-	3	2	3

MODULE-1	**Multiprocessors and Thread level parallelism**	**22CSE643.1**	**8 Hours**
Introduction, Symmetric shared memory architectures; Performance of symmetric shared-memory multiprocessors, Distributed shared memory and directory-based coherence, Basics of synchronization, Models of memory consistency.			
Text Book	Text Book 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6		
MODULE-2	**Data-Level Parallelism in Vector, SIMD, and GPU Architectures**	**22CSE643.2**	**8 Hours**
Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, Detecting and Enhancing Loop-Level Parallelism, Mobile versus Server GPUs and Tesla versus Core i7.			
Text Book	Text Book 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7		
MODULE-3	**Instruction-Level Parallelism and Its Exploitation Instruction-Level Parallelism:**	**22CSE643.3, 22CSE643.4**	**8 Hours**
Concepts and Challenges – Basic Compiler Techniques for Exposing ILP – Reducing Branch Costs with Prediction – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Algorithm and Examples – Hardware-Based Speculation – Exploiting ILP Using Multiple Issue and Static Scheduling – Exploiting ILP Using Dynamic Scheduling, Limitations on ILP for Realizable Processors –Using ILP Support to Exploit Thread-Level Parallelism.			
Case Study	• ILP-Software Carry Save.		
Text Book	Text Book 1: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.12		
MODULE-4	**Introduction to Parallel Computing:**	**22CSE643.5**	**8 Hours**
Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.			
Text Book	Text Book 2: 2.1, 2.2, 2.4, 2.5, 2.6, 2.7		
MODULE-5	**Principles of Parallel Algorithm Design:**	**22CSE643.6**	**8 Hours**
Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. **Basic Communication Operations:** One-to-All Broadcast and All-to-One Reduction, All to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, All-to-All Personalized Communication.			
Case Study	• Parallel computing on Google's Infrastructure. • Parallel computing on Telephone and cellular networks.		

Text Book	Text Book 2: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1, 4.2, 4.3, 4.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. David.A.Patterson, John L.Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 6th Edition 2019.
2. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, 2nd Edition, 2013, Pearson Education, ISBN 13: 9788131708071.

Reference Books:

1. Parallel Programming with Open ACC, Rob Farber, 1st Edition, 2016, Morgan Kaufmann (MK) Publication, ISBN :9780124103979.
2. An Introduction to Parallel Programming, Peter S. Pacheco, 2011, 1st Edition, Morgan Kaufmann Publishers, Print Book ISBN:9780123742605 eBook ISBN:9780080921440

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=WKw_e8j3Bu8**
- **https://www.youtube.com/watch?v=ZGUP5nUdIyc**
- **https://www.youtube.com/watch?v=q7sgzDH1cR8**
- **https://www.youtube.com/watch?v=-nSO3yuM6ss&list=PLiKFau7eKJlqoHxgx_hjLN-xFup7a13Va**
- **https://www.youtube.com/watch?v=vNzz2tV13Y4**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

BLOCKCHAIN TECHNOLOGY

Course Code	**22CSE644**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CSE644.1	Understand the fundamentals of Blockchain Technology in different domains
22CSE644.2	Apply the various cryptographic mechanisms and network protocols used in Blockchain
22CSE644.3	Analyze smart contracts using solidity programs
22CSE644.4	Design the decentralized applications using Blockchain
22CSE644.5	Classify the industry applications using regulatory considerations
22CSE644.6	Identify projects which are ethical and contain social Implications

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE644.1	3	-	-	-	3	-	-	-	-	-	-	2	3	-
22CSE644.2	3	3	-	-	3	-	-	-	-	-	-	2	3	-
22CSE644.3	3	3	3	-	3	-	-	-	3	-	-	-	3	-
22CSE644.4	3	3	3	-	3	-	-	-	3	-	-	-	3	-
22CSE644.5	3	3	3	-	3	-	-	-	3	-	-	-	3	-
22CSE644.6	3	3	-	-	3	-	-	-	3	-	-	-	3	-

MODULE-1	**BLOCKCHAIN FUNDAMENTALS**	**22CSE644.1**	**8 Hours**

Overview of Blockchain Technology: Pros and Cons of Blockchain, Historical development and background, Key components and participants in a blockchain network, Distributed Ledger Technology, Consensus mechanisms, mining.

Types of Blockchains: Public, private, and consortium blockchains, Permissioned and permissionless blockchains, Use cases for different types of blockchains, Blockchain wallets.

Text Book	Text Book 1: Chapter 1,2,3

MODULE-2	**BLOCKCHAIN SECURITY PROTOCOLS**	**22CSE644.2**	**8 Hours**

Cryptography and Security: Cryptographic principles in blockchain, Public and private key cryptography, Security challenges and solutions, Understanding digital signatures, Merkle Trees.

Blockchain Networks and Protocols: Bitcoin and Ethereum as case studies, Other prominent blockchain platforms (e.g., Hyperledger, Corda), Interoperability and cross-chain communication.

Text Book	Text Book 1 : Chapter 4,5

MODULE-3	**SMART CONTRACT APPLICATION DEVELOPMENT**	**22CSE644.3, 22CSE644.4**	**8 Hours**

Solidity: Introduction, Need and features, Types, Structures, Control Flow and Smart contract structure- smart contract programs using solidity.

Decentralized Applications: Introduction to DApps and their characteristics, Building DApps using blockchain platforms, Usability and scalability challenges of DApps.

Text Book	Text Book 1 : Chapter 10

MODULE-4	**INDUSTRY USECASES AND LEGAL**	**22CSE644.5**	**8 Hours**

Use Cases and Industry Applications : Finance and cryptocurrencies, Supply chain management and traceability, Healthcare and identity management, Voting and governance systems

Legal and Regulatory Considerations : Blockchain and data privacy, Intellectual property issues in blockchain applications, Regulatory challenges and compliance

Text Book	Text Book 1 : Chapter 8,9

MODULE-5	**ETHICAL CONSIDERATIONS AND FUTURE TRENDS**	**22CSE644.6**	**8 Hours**

Ethical and Social Implications: Addressing trust and transparency, Potential societal impacts of blockchain adoption, Responsible block chain development and usage.

Future Trends and Challenges: Emerging technologies in blockchain (e.g., sharding, sidechains), Environmental impact and sustainability, Scalability and performance improvements.

Text Book	Text Book1: Chapter 6,7

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	-	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Mark Gates, Blockchain : ultimate guide to understanding Blockchain, Bitcoin, cryptocurrencies, smart contracts and the future of money, Wise Fox publishing, 2017.

Reference Books:

1) Daniel Drescher, Blockchain Basics, Apress, 2017.

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=SSo_EIwHSd4**
- **https://www.youtube.com/watch?v=_J6G5g-nKg0&pp=ygUjYmxvY2tjaGFpbiBzb2xpZGl0eSBzbWFydCBjb250cmFjdHM%3D**
- **https://www.youtube.com/watch?v=yubzJw0uiE4**
- **https://www.youtube.com/watch?v=ZE2HxTmxfrI**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any IT company which uses Blockchain Technology
- Demonstration of sample projects done using Blockchain
- Video demonstration of latest trends in Blockchain Technology
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and algorithms
  - Organizing Group wise discussions

ADVANCED DATABASES			
Course Code	**22CSE645**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CSE645.1	Understand the fundamentals of Storage and Indexing, including Disks and Files.
22CSE645.2	Apply Tree-Structured indexing principles for various operations.
22CSE645.3	Examine and Implement Hash-Based Indexing in various scenarios.
22CSE645.4	Assess queries using external sorting algorithms.
22CSE645.5	Evaluate queries involving relational operators.
22CSE645.6	Evaluate from the stages of physical database design and optimization.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE645.1	3	-	-	-	-	-	-	-	-	-	-	2	2	3
22CSE645.2	3	3	-	-	-	-	-	-	-	-	-	-	-	3
22CSE645.3	3	3	3	-	-	-	-	-	-	-	-	-	-	3
22CSE645.4	3	3	3	2	-	-	-	-	-	-	-	-	-	3
22CSE645.5	3	3	3	2	-	-	-	-	-	-	-	-	2	-
22CSE645.6	3	3	3	2	-	-	-	-	-	-	-	2	-	-

MODULE-1	**Data Storage and Management: Navigating the Digital Landscape**	**22CSE645.1**	**8 Hours**

Data on external storage; File organizations and indexing; Index data structures; Comparison of file organizations; Indexes and performance tuning Memory hierarchy; RAID; Disk space management; Buffer manager; Files of records; Page formats and record formats.

Case Study	**Case Study Title:** "Optimizing Data Warehousing for E-Commerce" **Description:** Imagine a large e-commerce company that handles millions of transactions daily and stores vast amounts of data, including customer profiles, product information, and sales records. Explore the challenges and solutions related to data management, storage, and performance optimization in such an environment. Through this case study, students gain a deep understanding of how advanced data management techniques are applied to meet the specific demands of a high-traffic e- commerce platform. It showcases the practical application of concepts related to external storage, indexing, memory hierarchy, RAID, and more in a real-world context, highlighting the importance of efficient data handling in the digital retail industry.
Text Book	Text Book 1: 8, 9.

MODULE-2	**Indexing Unveiled: From Tree Structures to Hashing Techniques**	**22CSE645.2, 22CSE645.3**	**8 Hours**

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice.
Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, comparisons.

Self-study / Case Study / Applications	**B+ Trees in Practice:** ● Explore real-world examples where B+ trees are used, such as in relational database management systems (RDBMS) or file systems. ● Investigate any recent advancements or adaptations of B+ trees in modern database systems. **Comparisons Between Hash-Based Indexing Methods:** ● Conduct a literature review to find academic papers or articles that analyze and compare the performance of static hashing, extendible hashing, and linear hashing. ● Summarize the findings and create a list of pros and cons for each method. **Practical Use Cases:** ● Investigate real-world applications where hash-based indexing is employed, such as in-memory databases, distributed systems, or key-value stores.

	Analyze how these systems leverage hash-based indexing for efficient data retrieval and storage.		
Text Book	Text Book 1: 10, 11.		
MODULE-3	**Database Optimization: From Operators to Query Planning**	**22CSE645.4**	**8 Hours**
The system catalog, Introduction to operator evaluation; Algorithms for relational operation, Introduction to query optimization; Alternative plans: A motivating example what a typical optimizer does. When does a DBMS sort data? A simple two-way merge sort; External merge sort.			
Self-study / Case Study / Applications	**Case Study 1: Sorting Big Data for Financial Analytics** When Does a DBMS Sort Data?; A Simple Two-Way Merge Sort; External Merge Sort Description: A financial analytics firm needs to process and analyze large datasets of stock market transactions. The case study focuses on sorting techniques to efficiently organize & process this data. **Key Topics Covered:** ● When Does a DBMS Sort Data? Explain under what circumstances a DBMS decides to perform sorting operations, especially in financial data processing. ● Two-Way Merge Sort: Detail the principles of a simple two-way merge sort algorithm and its applicability in sorting financial transaction data. ● External Merge Sort: Dive into the concept of external merge sort and how it handles datasets that do not fit entirely in memory. ● Performance Comparison: Compare the performance of different sorting algorithms (e.g., quicksort, external merge sort) for sorting financial transaction records. Parallel Processing: Discuss how parallel processing and distributed computing frameworks can be employed to further accelerate data sorting.		
Text Book	Text Book 1: 12, 13 till 13.3.		
MODULE-4	**Relational Operator Evaluation and Contemporary Database Applications**	**22CSE645.5**	**8 Hours**
Evaluating Relational Operators: The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering. **More Recent Applications**: Mobile databases; Multimedia databases, geographical Information Systems, Genome data management.			
Self-study / Case Study / Applications	**Case Study Title: "Optimizing Genomic Data Analysis with Relational Operators" -** Genomic research generates vast amounts of data, including DNA sequences, genetic variations, and clinical information. Efficiently managing and analyzing this data is crucial for advancements in healthcare and personalized medicine. This case study explores how relational operators and database principles are applied to enhance genomic data analysis.		
Text Book	Text Book 1: 14, 29.3, 29.5 & 29.6.		
MODULE-5	**Strategies for Efficient Indexing and Database Tuning**	**22CSE645.6**	**8 Hours**
Introduction, Guidelines for index selection, examples; Clustering and indexing; Indexes that enable index-only plans; Tools to assist in index selection; Overview of database tuning; Choices in tuning the conceptual schema; Choices in tuning queries and views; Impact of concurrency; DBMS benchmarking.			
Self-study / Case Study / Applications	**Use Case Analysis: Optimizing a Retail Database for Performance and Scalability** - A leading online retail company faces challenges related to the performance and scalability of its database system as its customer base continues to grow rapidly. This use case analysis explores how the company employs database indexing, tuning, and benchmarking strategies to address these issues.		
Text Book	Text Book 1: 20		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s) NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	20
L4	Analyze	20
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

2) Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

References:

1) Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.

Web links and Video Lectures (e-Resources):

- Plurasight video lectures: https://www.pluralsight.com/browse?=&q=databases&type=all&sort=default&level=Advanced
- edX video lectures: https://www.youtube.com/watch?v=poEfLYH9W2M

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Database Security and Authentication Exercises:**
  - Create scenarios to implement security measures for a database, including user authentication, authorization, and encryption.
  - Attend challenges to identify and fix security vulnerabilities in a given database.
- **NoSQL Database Exploration:**
  - Explore NoSQL databases like MongoDB or Cassandra.
  - Design and implement a NoSQL database schema to handle specific types of data, such as unstructured text or time-series data.
- **Database Performance Tuning:**
  - Consider with a poorly performing database and identify bottlenecks and optimize its performance.
  - Use performance monitoring tools to analyze query execution plans and resource utilization.
- **Real-World Case Studies:**
  - Present with real-world database challenges faced by companies or organizations.
- Analyze the problem, design solutions, and present their findings, fostering critical thinking and problem-solving skills.

PROJECT PHASE - I

Course Code	**22CSE65**	**CIE Marks**	**50**
L:T:P:S	**0:0:2:0**	**SEE Marks**	**50**
Hrs / Week	**00**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Course outcomes:

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

22CSE65.1	Identify societal problems under sustainable development goals and classify them under different domains of computer science and engineering and interdisciplinary perspective.
22CSE65.2	Demonstrate the ability to conduct comprehensive literature reviews using appropriate research databases, search strategies, and citation management tools to identify relevant sources of information.
22CSE65.3	Analyze existing literature and formulate the problem statement.
22CSE65.4	Formulate an idea and share the idea in a suitable platform
22CSE65.5	Organize the article logically, following a structured format with well-defined sections such as introduction, background, methodology, Analysis discussion, and conclusion.
22CSE65.6	Demonstrate their communication skill effectively with the technical presentation.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
22CSE65.1	3	3	2	-	-	3	2	-	3	3	1	2	-	2
22CSE65.2	3	3	3	2	-	3	2	-	3	3	1	2	-	2
22CSE65.3	3	3	3	2	1	3	-	2	3	3	-	2	2	2
22CSE65.4	3	3	3	2	2	-	-		3	3	-	2	2	2
22CSE65.5	3	3	3	2	2	-	1	-	3	3	-	2	2	2
22CSE65.6	3	-	-	-	2	-	-	-	3	3	-	2	2	2

Project Phase 1: Roadmap, activities, and deliverables

Goal Selection and Project Planning:

- Identification of suitable topic based on Sustainable Development Goals.
- Forming project teams based on common interests and skill sets.
- Teams' involvement in developing project proposals outlining objectives, strategies, and expected outcomes.

Research and Needs Assessment:

- Survey conduction by thorough research on the chosen SDGs, including global and local context, challenges, and opportunities.
- Conduct needs assessments to identify specific issues or gaps that student projects can address

Interdisciplinary approaches:

- Applying interdisciplinary approaches and innovative solutions to tackle sustainability challenges.

Knowledge Sharing and Communication:

- students to share their project experiences and insights through presentations, reports, and social media.
- Foster peer-to-peer learning and collaboration by creating platforms for knowledge exchange and networking.

CIE Assessment Pattern (50 Marks – Demo and Viva)

RBT Levels		**Periodical Reviews & Evaluation**
		50
L1	**Remember**	**5**
L2	**Understand**	**5**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	**10**
L6	**Create**	**10**

SEE Assessment Pattern (50 Marks – Demo and Viva)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

Suggested Learning

Resources:

1. Johnson, L. M., & Brown, A. S. (2021), Modern Software Project Management: Strategies and Best Practices. Tech Knowledge Publishers.
2. Sustainable Development Goals: An Indian Perspective (Sustainable Development Goals Series) 1st ed. 2020 Edition,Somnath Hazra , Springer
3. McConnell, S. (2021), Software Project Survival Guide (2nd ed.). Microsoft Press. Schwalbe, K. (2022), Information Technology Project Management (9th ed.). Cengage Learning.

Web links and Video Lectures (e-Resources):

- https://www.project-everyone.org/
- https://www.instructables.com/Engineering-1/
- https://www.hackster.io/
- https://owl.purdue.edu/ (For writing effective articles)
- https://github.com/

PROBLEM SOLVING SKILLS

Course Code	**22SDK66**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**01**	**Exam Hours**	**1**

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

22SDK66.1	Infer the complex problems using the concepts of data structures and C programming
22SDK66.2	Apply object-oriented programming concepts in C++and Java to solve real time problem statements.
22SDK66.3	Solve real-world problem using python and C#
22SDK66.4	Develop the skills of handling data base queries and procedures

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22SDK66.1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.3	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.4	3	3	3	2	2	-	-	-	-	-	-	2	2	2

MODULE-1	**Problem Solving On Data Structures And C**	**22SDK66.I**	**6 Hours**

Data Structures using C: Stack and queues, list, graph, tree, sorting and searching, Hash functions
Advanced C programming: Pointers, Recursion, Functions, Structure, Union, C Preprocessor

MODULE-2	**Problem Solving On Object Oriented Programming Using CPP**	**22SDK66.2**	**6 Hours**

Object Oriented Programming: Inheritance, Polymorphism, Exception handling, File Handling, Predefined function, Void function, Name spaces, Input and output streams.

MODULE-3	**Problem Solving On Java And Xml**	**22SDK66.2**	**6 Hours**

Object oriented programming using Java: Inheritance, Polymorphism, Abstract class and Interface, Collections, Exception handling, Streams, Functional Interface.
XML: DTD, Schema, Server Path, DOM, XSLT, Name Space, AJAX.

MODULE-4	**Problem Solving Using C # And Python**	**22SDK66.3**	**6 Hours**

Python: Functions, iterators, Object oriented Programming, Exception Handling, Packages, Frame works-Django, Collections.
C#: Object oriented Programming, Delegate, Collections and generic, Name space.

MODULE-5	**Scenario Based Problems On Dbms**	**22SDK66.4**	**6 Hours**

ER Model, SQL- DDL, DML, TCL, DCL, Joins, subquery, PL/SQL-Index, Sequence, procedures and functions, normalization, B tree, B+ tree, Forms.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s)
		50
L1	Remember	5
L2	Understand	10
L3	Apply	20
L4	Analyze	15
L5	Evaluate	
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Martin C Brown, "Python-The Complete Reference", Mc Graw Hill, 4th edition, 2020
2. Reema Tharega, "Data Structures using C", Oxford University Press, 2020
3. Ullakirch-Prinz, "A complete guide to program in C++", Jonas and Bartlett Learning, 2022
4. Kathy Sierra, "Headfirst Java", O'reilly Media, 2021
5. Andrew Stellman, "Headfirst C#", O'reilly Media, 2021

Web links and Video Lectures (e-Resources):

1. **https://www.learncpp.com/**
2. **https://www.programiz.com/dsa**
3. **https://code.visualstudio.com/Docs/languages/csharp**
4. **https://www.udemy.com/course/the-complete-java-course-from-basics-to-advanced/?couponCode=ST16MT70224**
5. **https://www.codecademy.com/learn/paths/c**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Analysis of industry relevant use cases
- Problem solving on scenario-based questions
- Placement portal practice sessions

MOBILE APPLICATION DEVELOPMENT

Course Code	**22CSE671**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

22CSE671.1	Design single screen mobile applications by setting up Android development environment.
22CSE671.2	Develop mobile applications using Intents.
22CSE671.3	Design mobile applications using files and Databases.
22CSE671.4	Develop mobile applications using SMS services.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE671.1	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSE671.2	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSE671.3	3	3	3	3	2	-	-	-	1	1	-	2	3	3
22CSE671.4	3	3	3	3	2	-	-	-	1	1	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Proficiency in a programming language (Java) and design guidelines	2	NA
	PART-A		
1	Develop an Android application to display "Hello NHCE". Customise the layout with font and colour.	2	**22CSE671.1**
2	Develop an Android application that displays information about a small business. Your design must include: • Business name • Photo of business • Contact information and • Description of Business	2	**22CSE671.1**
3	Develop an Android application using Button, TextView and EditText for designing a Calculator having basic functionality like Addition, Subtraction, Multiplication and Division.	2	**22CSE671.1**
4	Develop an Android application The Easy Unit Converter using Radio Buttons.	2	**22CSE671.1**
5	Develop an Android application Currency Converter using Spinners.	2	**22CSE671.1**
6	Develop an Android application using Explicit intent to display the login page. On giving the wrong credentials it should display the toast message and if credentials are correct it should display Welcome and the username.	2	**22CSE671.2**
	PART-B		
7	Develop an Android application using Implicit intent to display the Gallery and Call buttons. On clicking these buttons, it should goto the respective pages.	2	**22CSE671.2**
8	Initiate an email composition by employing an Intent	2	**22CSE671.2**
9	Develop an Android application Tourist spot with three activities : Welcome page, Display attractions of tourist spot and Webpage of the tourist spot.	2	**22CSE671.2**
10	Develop an Android application The Expense Manager using Android. The application should store all the expenses in a file.	2	**22CSE671.3**
11	Develop an Android application Student Database App using Android. The app should store USN, Student name and Semester of student in SQLite database.	2	**22CSE671.3**
12	Develop an Android application to alert SMS to one given phone number.	2	**22CSE671.4**

PART-C

Beyond Syllabus Virtual Lab Content

- https://apexapps.oracle.com/pls/apex/r/dbpm/livelabs/run-workshop?p210_wid=3620

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	CIEs
		30	20
L1	Remember	-	-
L2	Understand	10	-
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Reto Meier; Professional Android 4 Application Development; Wiley India Pvt.ltd; 1st Edition; 2012; ISBN-13: 9788126525898.
2) Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition - Big Nerd Ranch Guide; 2015; ISBN-13, 978-0134171494.

Reference Books:

1) Mark Murphy; Beginning Android 3; Apress Springer India Pvt Ltd. ;1st Edition; 2011;ISBN-13: 978-1-4302-3297-1
2) Eric Hellman; Android Programming – Pushing the limits by Hellman; Wiley; 2013; ISBN 13: 978-1118717370.

DATA VISUALISATION TOOLS

Course Code	**22CSE672**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

22CSE672.1	Understand the key techniques and theory behind data visualization and various Data visualization tools.
22CSE672.2	Use visualization tools to conduct data analysis, especially exploration of an unfamiliar dataset.
22CSE672.3	Apply tools for data transformation and Integrate Tableau with other programming languages
22CSE672.4	Evaluate the analytics features, design interactivity, formatting dashboards and publishing content for effective data

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE672.1	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
22CSE672.2	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
22CSE672.3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
22CSE672.4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Proficiency in a programming language (Python) and design mathematical functions and graphs and charts.	2	NA
	PART-A		
1	Introduction to various Data Visualization tools and dashboard functions and understand their usage	2	**22CSE672.1**
2	Implementation of Basic Visualization in Python	2	**22CSE672.1**
3	a) Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.	2	**22CSE672.2**
4	a) Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib. b) Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.	2	**22CSE672.2**
5	Develop a Python program to illustrate Linear Plotting using Matplotlib.	2	**22CSE672.2**
6	Develop a Python program to illustrate liner plotting with line formatting using Matplotlib.	2	**22CSE672.2**
	PART-B		
7	Installation and Introduction to Tableau basic functions.	2	**22CSE672.3**
8	Implement functions to connect to Data and execute steps for preparing data for visualization in Tableau	2	**22CSE672.3**
9	Create dashboard to show Data Aggregation and Statistical functions in Tableau	2	**22CSE672.3**
10	Use Tables to show Data Visualizations in Tableau	2	**22CSE672.3**
11	Use data and tables to showData Visualizations in PowerBI	2	**22CSE672.4**
12	Basic Dashboards in PowerBI	2	**22CSE672.4**

PART-C

Beyond Syllabus Virtual Lab Content

- https://library.ndsu.edu/locations/main-library/data-visualization-lab
- https://www.iiitmk.ac.in/DAVirtalLab/
- https://idatavisualizationlab.github.io/

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Weekly Assessment (s)	Test (s)
		30	20
L1	Remember	--	--
L2	Understand	5	--
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	5	
L6	Create	--	--

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures
2. Visualization in seaborn for data science: create plots using single line of code, Partha misra 2023
3. Shai Vaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014.

Reference books:

1. "Dashboard Playbook: Data Viz to Data Wiz: Tableau & PowerBI" by hayden Van Der Post October 2023

.

WEARABLE TECHNOLOGIES

Course Code	**22CSE673**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

22CSE673.1	Recall the fundamental concepts of wearable technology and its significance of external metrics for improving wearable usability.
22CSE673.2	Apply techniques for identifying human body signals using wearable devices.
22CSE673.3	Examine and assess the data analytics methods for integrating external and internal metrics from wearable devices.
22CSE673.4	Generate interpretations and insights from innovations and real-time data collection in wearable and related technologies.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE673.1	3	2	1	1	-	-	-	-	-	-	-	3	-	-
22CSE673.2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
22CSE673.3	3	3	2	1	2	-	-	-	-	-	-	3	3	2
22CSE673.4	3	3	3	1	2	-	-	-	-	-	-	3	2	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Usage of smart devices		**NA**
	PART-A		
1	Measure Step Counts with Mobile Applications and Wearable Devices	2	**22CSE673.1**
2	Track Heart Rate Changes Across Various Physical Activities	2	**22CSE673.1**
3	Record and Assess Sleep Patterns	2	**22CSE673.2**
4	Examine the Influence of Motion on Heart Rate Tracking	2	**22CSE673.2**
5	Assess Data Accuracy in Wearables: The Battery Life Factor	2	**22CSE673.2**
6	Analyze GPS Accuracy in Wearable Devices: The Signal Strength Factor	2	**22CSE673.2**
	PART-B		
7	Analyze Heart Rate Variability (HRV) Examining Sleep Stage Monitoring with Wearable Technology	2	**22CSE673.3**
8	Explore the Wearable Device's Body Temperature Monitoring Functionality	2	**22CSE673.3**
9	Explore the interplay between wearable devices and posture-related feedback on internal metrics. Understand how these devices collect data, integrate external and internal measures, and assess their impact on health and performance.	2	**22CSE673.3**
10	Quantify Wellness: Calculate a comprehensive wellness index to gauge overall health and well-being.	2	**22CSE673.4**
11	Fitness Evaluation: Assess individual fitness levels to tailor fitness programs and goals effectively	2	**22CSE673.4**
12	Stress Management Index: Measure and manage stress levels through a dedicated index, promoting well-rounded health.	2	**22CSE673.4**

PART-C

Beyond Syllabus Virtual Lab Content

- https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/
- https://sl-coep.vlabs.ac.in/exp/temperature-sensor/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	Lab CIE Test
		30	20
L1	Remember	-	-
L2	Understand	10	-
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. The ultimate guide to informed wearable technology by Christine Farion, Packt, ISBN: 9781803230597, 2022.
2. Wearable Technologies, Nicola Carbonaro and Alessandro Tognetti, MDPI, ISBN: 9783038975137, 2019.

Reference Books:

1. Wearable-Tech Projects with the Raspberry Pi Zero" by Jon Witts.
2. Programming Wearables with Android" by Christopher Kardas and Shane Conder.

Web Links and Video Lectures

- https://www.coursera.org/learn/wearable-technologies#modules
  https://learn.adafruit.com/category/wearables
- https://developer.android.com/wear
- https://www.arduino.cc/en/Guide/WearableProjects
- https://www.instructables.com/circuits/howto/wearable-tech/

EMBEDDED PROGRAMMING

Course Code	**22CSE674**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

22CSE674.1	Interpret the interfacing of sensors with Arduino to collect and process data.
22CSE674.2	Analyze the process to control the actuators using Arduino.
22CSE674.3	Analyze skills in data acquisition and analysis using Arduino and related software tools.
22CSE674.4	Enhance the problem-solving skills by designing solutions to real-world problems using Arduino.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE674.1	3	2	1	-	-	-	-	-	-	-	-	3	-	-
22CSE674.2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
22CSE674.3	3	3	2	1	2	-	-	-	-	-	-	3	3	2
22CSE674.4	3	3	3	1	2	-	-	-	-	-	-	3	2	2

Exp. No. / Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Setting up of Arduino IDE and familiarization of Arduino Board		**NA**
	PART-A		
1	Turn ON/OFF an LED with a button press using Arduino embedded programming	1	22CSE674.1
2	Control an RGB LED to display different colors using PWM	1	22CSE674.1
3	Control the LED blink rate with the potentiometer interfacing with Arduino	1	22CSE674.1
4	Interfacing of temperature sensor LM35 with Arduino	1	22CSE674.1
5	Use a photoresistor to measure light intensity and display the readings	1	22CSE674.2
6	Interfacing Servo Motor with the Arduino	1	22CSE674.2
	PART-B		
7	Direction Control of the DC motor using Arduino	1	22CSE674.2
8	Building Intrusion Detection System with Arduino and Ultrasonic Sensor	1	22CSE674.3
9	Create a mini weather station that measures temperature, humidity, and atmospheric pressure	1	22CSE674.3
10	Implement an RFID-based door lock system for security purposes.	1	22CSE674.4
11	Design a traffic light system that adjusts its timing based on real-time traffic conditions using sensors	2	22CSE674.4
12	Create a simple alarm system that sounds a buzzer when a condition is met (e.g., temperature exceeds a threshold)	2	22CSE674.4

PART-C

Beyond Syllabus Virtual Lab Content

- Arduino simulator AND (tinkercad.com)
- https://fritzing.org

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	CIE Test
		30	20
L1	Remember	-	-
L2	Understand	10	-
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**15**
L4	**Analyze**	**15**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Jack Purdum ; Beginning C for Arduino: Learn C Programming for the Arduino (Technology in Action) ; 1st ed. Edition, 2021, ISBN: 978-1430247760
2. J. M. Hughes; Arduino: A Technical Reference: A Handbook for Technicians, Engineers, and Makers; 1st Edition; 2022; ISBN: 978-1491934500

Reference Books:

3. Jeremy Blum; Exploring Arduino: Tools and Techniques for Engineering Wizardry; Wiley; 2nd Edition; 2019; 9781119405375
4. Michael Margolis, Brian Jepson, Nicholas Robert Weldin; Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects; O'Reilly Media, Inc.; 3rd Edition; ISBN: 978-1491903520

CONTAINERIZATION TOOLS			
Course Code	**22CSE675**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

22CSE675.1	Design basic Docker containers and images for running simple applications.
22CSE675.2	Develop Docker-based multi-container applications with security best practices.
22CSE675.3	Implement advanced Kubernetes features for deploying, managing, and securing containerized applications.
22CSE675.4	Develop CI/CD pipelines and explore container orchestration tools like Docker Swarm.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22CSE675.1	3	3	2	-	-	-	-	-		-	-	2	3	3
22CSE675.2	3	3	3	2	3	-	-	-	1	1	-	2	3	3
22CSE675.3	3	3	3	2	3	-	-	-	1	1	-	2	3	3
22CSE675.4	3	3	3	2	3	1	1	1	1	1	-	2	3	3

Exp. No. / Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Proficiency in a programming language and basic understanding of operating systems, command-line interfaces, and networking concepts.	1	NA
	PART-A		
1	Develop a simple Docker container that prints "Hello World" when run.	1	**22CSE675.1**
2	Create a Docker image from a Docker file to run a simple web application.	1	**22CSE675.1**
3	Build a Docker container to run a Python script that performs basic file operations.	1	**22CSE675.1**
4	Create a Docker image for a Node.js application that serves a static HTML page.	1	**22CSE675.1**
5	Use Docker Compose to set up a multi-container application with a web server and a database.	1	**22CSE675.2**
6	Secure a Docker container by implementing best practices for user permissions and network security.	1	**22CSE675.2**
	PART-B		
7	Deploy a simple application on a local Kubernetes cluster using Minikube.	1	**22CSE671.3**
8	Configure Kubernetes network policies to restrict traffic between pods.	1	**22CSE671.3**
9	Implement a Kubernetes ingress controller to manage external access to services.	1	**22CSE671.3**
10	Set up monitoring and logging for a Kubernetes cluster using Prometheus and Grafana.	1	**22CSE671.3**
11	Create a CI/CD pipeline to automate the build, test, and deployment of a Docker application.	2	**22CSE671.4**
12	Explore and implement Docker Swarm for container orchestration and compare it with Kubernetes.	1	**22CSE671.4**

PART-C

Beyond Syllabus Virtual Lab Content

- https://dockerlabs.collabnix.com/
- https://docs.docker.com/language/nodejs/

- https://docs.docker.com/engine/security/
- https://minikube.sigs.k8s.io/docs/
- https://grafana.com/
- https://spacelift.io/blog/docker-ci-cd

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	Lab CIE Test
		30	20
L1	Remember	-	-
L2	Understand	10	-
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Gabriel N. Schenker; Hideto Saito; Hui-Chuan Chloe Lee; Ke-Jou Carol Hsu, "Getting Started with Containerization", Packt Publishing, 2019, ISBN: 9781838649036
2. Nisarg Vasavada, Dhwani Sametriya, "Cracking Containers with Docker and Kubernetes ", BPB Publications, 2021, ISBN-9391030793, 9789391030797

Reference Books:

1. Nigel Poulton, "The Docker Book: Containerization Is the New Virtualization", Independently published, 2018, ISBN-10: 1521822808, ISBN-13: 978-1521822808.
2. James Turnbull, "The Docker Book: Containerization Is the New Virtualization", Independently published, 2018, ISBN-10: 1521822808, ISBN-13: 978-1521822808.
3. Adrian Mouat, "Using Docker: Developing and Deploying Software with Containers", O'Reilly Media, 2015, ISBN-10: 1491915765, ISBN-13: 978-1491915769.
4. Joe Beda, Kelsey Hightower, Brendan Burns, "Kubernetes: Up & Running: Dive into the Future of Infrastructure", O'Reilly Media, 2017, ISBN-10: 1491935677, ISBN-13: 978-1491935675

NATIONAL SERVICE SCHEME (NSS)

Course Code	**22NSS60**	**CIE Marks (each Semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

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

22NSS60.1	Understand the importance of his / her responsibilities towards society.
22NSS60.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSS60.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
22NSS60.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22NSS60.1	-	-	-	-	-	3	3	-	2	-	-	1
22NSS60.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS60.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS60.4	-	-	-	-	-	3	3	-	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
6TH 22NSS60	1. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 2. Govt. school Rejuvenation and helping them to achieve good infrastructure.	22NSS60.1, 22NSS60.2, 22NSS60.3, 22NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

CIE component for every semester	Marks
Presentation – 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress -PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	**50**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Suggested Learning Resources:
Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.

- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1
    - Commencement of activity and its progress - PHASE – 2
    - Execution of Activity
    - Case study-based Assessment, Individual performance
    - Sector/ Team wise study and its consolidation
    - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation	Evaluation as per the rubrics of scheme and syllabus by NSS officer

					authority	
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)

Course Code	**22PED60**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:

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

222PED60.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
22PED60.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
22PED60.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
22PED60.4	Understand the roles and responsibilities of organization and administration of sports and games

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
222PED60.	-	-	-	-	-	2	-	3	3	-	-	2
22PED60.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED60.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED60.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
6TH 22PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations)use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. A. Rules and their interpretation and duties of officials.	22PED60.1, 22PED60.2, 22PED60.3, 22PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	Hockey: A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. **9.** B. Rules and their interpretation and duties of officials		

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA

Course Code	**22YOG60**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**02**

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

22YOG60.1	Understanding the origin, history, aim and objectives of Yoga
22YOG60.2	Become familiar with an authentic foundation of Yogic practices
22YOG60.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
22YOG60.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22YOG60.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.4	-	-	-	-	-	3	-	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
6TH 22YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of: Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	**50**

Suggested Learning Resources:

Reference Books:

4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
5. Tiwari, O P: Asana Why and How
6. Ajitkumar: Yoga Pravesha (Kannada)
7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
9. Nagendra H R: The art and science of Pranayama
10. Tiruka: Shatkriyegalu (Kannada)
11. Iyengar B K S: Yoga Pradipika (Kannada)
12. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

- **https://youtu.be/KB-TYlgd1wE**
- **https://youtu.be/aa-TG0Wg1Ls**

Appendix A: List of Assessment Patterns

S.NO	Pattern of Assessments
1	Assignments
2	Group Discussions
3	Case Study / Caselets
4	Practical-Orientation on Design Thinking
5	Participatory & Industry-Integrated Learning
6	Practical Activities / Problem Solving Exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / Workshops
12	Any Other Academic Activity
13	Online / Offline Quizzes

APPENDIX B: Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes

APPENDIX C: The Graduate Attributes of NBA

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

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

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.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

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

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

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.

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

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

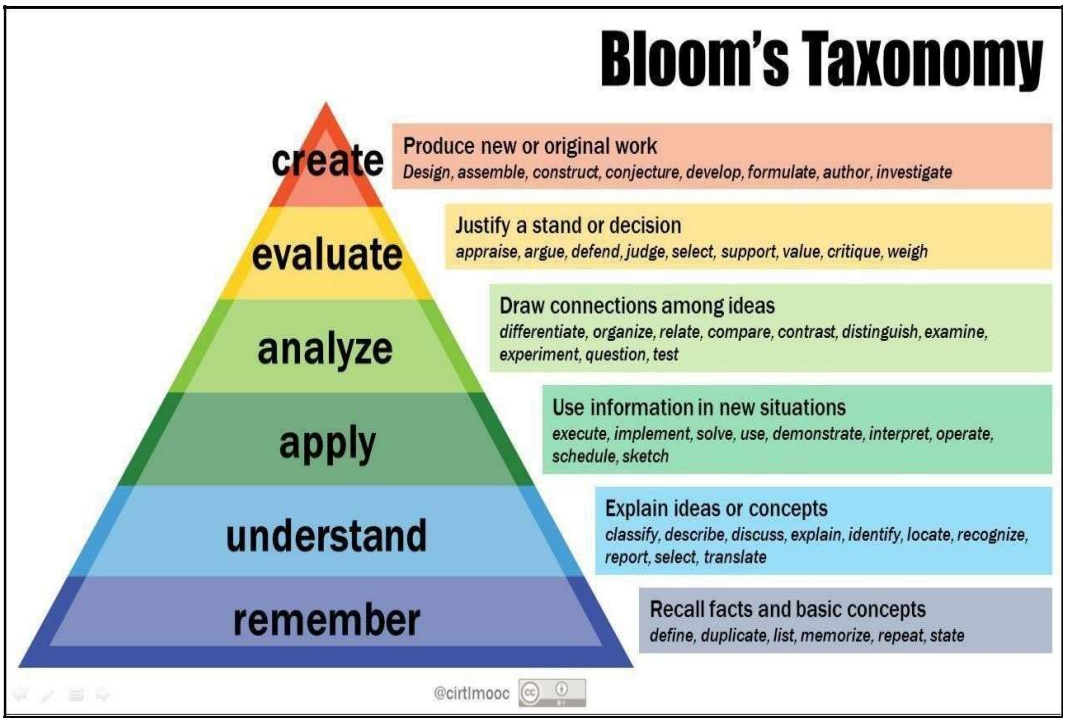
Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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.

APPENDIX D: BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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