



Department of Information Science and Engineering

Academic Year:2025-26



**5th and 6th Semester
Scheme & Syllabus**

Batch:2023-27

Credits:160

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NEW HORIZON COLLEGE OF ENGINEERING

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 academia and industry through their involvement in the design of the 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 educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level.

VALUES

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

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

VISION

To emerge as a Department of Eminence in Information 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, practical and ethical dimensions of the learning process by continuous learning and establishing a culture of research and innovation among faculty members and students, in the field of information science and engineering.
- To build long-term interaction between the academia and Information Technology 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.

Program Education objectives (PEOs)

PEO 1	Excel as Information Science Engineers with the ability to solve a wide range of computational problems in the IT industry, Government or other work environments.
PEO 2	Pursue higher studies with profound knowledge enriched with academia and industrial skill sets.
PEO 3	Exhibit adaptive skills to develop computing systems using modern tools and technologies in multidisciplinary areas to meet technical and managerial challenges, which meet societal requirements.
PEO 4	Possess the ability to collaborate as a team member and leader with professional ethics to make a positive impact on society.

PEO to Mission Statement Mapping

PEO Statements	M1	M2	M3
PEO 1: Excel as an Information Science Engineer with the ability to solve a wide range of computational problems in the IT industry, Government or other work environments.	3	3	2
PEO 2: Pursue higher studies with profound knowledge enriched with academia and industrial skill sets.	3	3	2
PEO 3: Exhibit adaptive skills to develop computing systems using modern tools and technologies in multidisciplinary areas to meet technical and managerial challenges which meet societal requirements.	3	3	3
PEO 4: Possess the ability to collaborate as a team member and leader with professional ethics to make a positive impact on society.	2	2	3

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

Program Specific Outcomes (PSO's)

PSO1: The ability to understand, analyze and develop computer programs in the areas of Information Science and Engineering related to System Software, Web Design, Big Data Analytics, Machine Learning, Internet of Things, Data Science, Networking and Security for efficient design of computer-based systems of varying complexity.

PSO2: The ability to apply standard practices and strategies in software project development using innovative ideas and open-ended programming environment with skills in teams and professional ethics to deliver a quality, sustainable product for business success in the field of Information Science.

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1.	Engineering Knowledge	PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2.	Problem analysis	PO2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.	Design and Development of Solutions	P03: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	Investigation of Problem	P04: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	Modern Tool usage	P05: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	Engineer and society	P06: 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.
7.	Environment and sustainability	P07: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	Ethics	P08: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	Individual & team work	P09: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	Communication	P010: 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.
11.	Lifelong learning	P011: 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.
12.	Project management and Finance	P012: 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.

Mapping of POs with PEOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PEO 1	3	3	3	2	3	-	-	-	3	-	3	-
PEO 2	3	3	3	2	3	-	-	-	3	-	3	-
PEO 3	3	3	3	2	3	-	-	-	3	-	3	-
PEO 4	3	3	3	2	3	-	-	-	3	-	3	-

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

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Information 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	22ISE51	Software Engineering and Project Management	IS	3	0	0	0	3	3	50	50	100
2	PCC	22ISE52	Design and Analysis of Algorithms	IS	3	0	0	0	3	3	50	50	100
3	PCCL	22ISL52	Design and Analysis of Algorithms Lab	IS	0	0	1	0	1	2	50	50	100
4	PCC	22ISE53	Data Science	IS	3	0	0	0	3	3	50	50	100
5	PCCL	22ISL53	Data Science Lab	IS	0	0	1	0	1	2	50	50	100
6	PEC	22ISE54X	Professional Elective Course-I	IS	3	0	0	0	3	3	50	50	100
7	AEC	22RMK55	Research Methodology and IPR	IS	1	1	0	0	2	3	50	50	100
8	AEC	22SDK56	Critical and Creative Thinking Skills	IS	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	22ISE58	Mini Project - II	IS	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)	Physical Education 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:** Minor 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			
22ISE541	Information Theory & Coding	22ISE543	Compiler Design
22ISE542	Principles of Cloud Computing	22ISE544	Operation Research
22ISE545	Advanced Java	22ISE546	Devops

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

Minor-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

- (i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)
- (ii) A group of 2- 4 if mini project work is single discipline (applicable to all Core Branches)
- (iii) 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-wise at the college level with the participation of all the guides of the 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.

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.

Credit Definition:

1- hour Lecture (L) per week=1Credit
 2-hoursTutorial(T) per week=1Credit
 2-hours Practical / Drawing (P) per week=1Credit
 2- hous Self Study for Skill Development (SDA) per week = 1 Credit

03-Credits courses are to be designed for 40 hours in Teaching-Learning Session
 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

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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	22ISE61	Machine Learning	IS	3	0	0	0	3	3	50	50	100
2	PCCL	22ISL61	Machine Learning Laboratory	IS	0	0	1	0	1	2	50	50	100
3	PCC	22ISE62	Computer Networks	IS	3	0	0	0	3	3	50	50	100
4	PCCL	22ISL62	Computer Networks Laboratory	IS	0	0	1	0	1	2	50	50	100
5	PCC	22ISE63	Cryptography and Information Security	IS	2	1	0	0	3	4	50	50	100
6	PEC	22ISE64X	Professional Elective Course-II	IS	3	0	0	0	3	3	50	50	100
7	PROJ	22ISE65	Project Phase - I	IS	0	0	2	0	2	0	50	50	100
8	AEC	22SDK66	Problem Solving Skills	IS	0	0	1	0	1	2	50	--	50
9	AEC	22ISE67X	Ability Enhancement Course – V	IS	0	0	1	0	1	2	50	50	100
10	OEC	25NHOP6XX	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)	Physical Education 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, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

Professional Elective Course-II			
22ISE641	Block Chain	22ISE643	Natural Language Processing
22ISE642	System Modelling and Simulation	22ISE644	Data Visualization
22ISE645	Bigdata Technologies	22ISE646	Storage Area Network

Ability Enhancement Course – V			
22ISE671	Project Management using GIT	22ISE674	Angular JS
22ISE672	Advanced Programming using C++		
22ISE673	NoSQL		

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. This 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.

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

FIFTH SEMESTER

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT															
Course Code	22ISE51								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:															
22ISE51.1	Understand the phases in a software project														
22ISE51.2	Understand fundamental concepts of requirements engineering and Analysis Modeling.														
22ISE51.3	Understand the various software design and coding methodologies														
22ISE51.4	Apply various testing and maintenance measures														
22ISE51.5	Apply various project management activities														
22ISE51.6	Analyze various project management activities and its maintenance														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	
22ISE51.1	3	-	1	2	-	-	-	-	-	-	1	1	2	2	
22ISE51.2	2	-	1	2	-	-	-	-	-	-	1	1	2	2	
22ISE51.3	2	-	3	2	-	-	-	-	-	-	1	1	2	2	
22ISE51.4	2	-	3	3	-	-	-	-	-	-	1	1	2	2	
22ISE51.5	1	-	1	2	-	-	-	-	-	-	1	1	2	2	
22ISE51.6	1	-	1	2	-	-	-	-	-	-	1	1	2	2	
MODULE-1	Introduction								22ISE51.1				8 Hours		
Introduction: Software Engineering; Software Processes: Lifecycle Models, Unified process; Agile Process Model development; Extreme Programming, Aspect-oriented software engineering and process															
Text Book			Text Book 1:Ch 2, Ch 4, Ch 5.												
MODULE-2	Requirements								22ISE51.2				8 Hours		
Software Requirements, Feasibility study, Requirement solicitation and analysis; Requirements Specification, validation and management.															
Text Book		Text Book 1: Ch 2													
MODULE-3	Software Design								22ISE51.3				8 Hours		
Data Design, Architectural Design; Component Level Design, User Interface Design, Object Oriented Design, Software Design Notations.															
Case Study / Applications		Object Oriented Design, Software Design Notations													
Text Book		Text Book1: Ch 13, Ch 14, Ch15													
MODULE-4	Software Coding and Testing								22ISE51.4				8 Hours		
Software Coding: Features of Software Code, Coding Guidelines, Coding Methodology, Programming Practice, Code verification Techniques, Coding Tools, Code Documentation Software Testing: Software Testing basics, Test Plan, Levels of Software Testing, Testing Techniques, Debugging, Safety, Security and reliability															
Case Study / Applications		Coding Tools, Code Documentation, Testing Techniques, Debugging, Safety													
Text Book		Text Book 1: Ch 22, Ch 23, Ch 25, Ch 26													
MODULE-5	Configuration Management								22ISE51.5, 22ISE51.6				8 Hours		
Configuration Management: Configuration Management Planning; Change management, Distributed Version Control Systems Project Management: Project planning; Project scheduling; Risk management, Management activities.															

Text Book

Text Book 1: Ch 33, Ch 34, Ch 35

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	10	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Roger S Pressman: Software Engineering–A Practitioner’s Approach, Mc-GrawHill, Eight editions, 2019.

2. Ian Somerville: Software Engineering, Pearson Education,Tenthedition,2017

Reference Books:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

2. Hans VanVliet: Software Engineering: Principles and Practices, Wiley India, 2018

3. Richard Fairley: Software Engineering Concepts, McGraw-Hill, 2018.

Web links and Video Lectures (e-Resources):

https://www.tutorialspoint.com/software_engineering/index.htm

<https://www.computerscience.org/careers/software-engineer/>

<https://www.javatpoint.com/software-engineering-tutorial>

<https://www.guru99.com/what-is-software-engineering.html>

<https://www.geeksforgeeks.org/software-engineering/>

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

Visit to any Software organization to know more about the coding tools and data design.

Demonstration of Levels of Software Testing

Demonstration of Aspect-oriented software engineering and process

Video demonstration of latest trends in Distributed Version Control Systems and Project planning

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

DESIGN AND ANALYSIS OF ALGORITHMS															
Course Code	22ISE52					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:															
22ISE52.1	Understand algorithms in terms of space and time complexity.														
22ISE52.2	Analyze problems using brute force, divide and conquer, decrease and conquer and transform and conquer techniques.														
22ISE52.3	Analyze problems using greedy, dynamic programming, backtracking and branch and bound approaches.														
22ISE52.4	Compare different classes of computational complexity.														
22ISE52.5	Analyze string matching, parallel and online algorithms.														
22ISE52.6	Apply appropriate algorithm design technique for a given problem.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
22ISE52.1	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
22ISE52.2	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
22ISE52.3	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
22ISE52.4	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
22ISE52.5	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
22ISE52.6	3	3	3	3	3	-	-	-	-	-	-	1	3	3	
MODULE-1	INTRODUCTION, BRUTE FORCE APPROACH								22ISE52.1, 22ISE52.2			8 Hours			
Introduction: Fundamentals of Algorithms, Problem Solving- Important Problem Types, Performance Analysis: Space complexity, Time complexity–Asymptotic notations and Basic efficiency classes: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis for Recursive and Non-recursive algorithms. Brute Force Approach: General Method, Simple string matching.															
Text Book		Text Book 1: 1.2, 1.3, 2.1,2.2,2.3,2.4,2.5,3.2													
MODULE-2	DIVIDE AND CONQUER, DECREASE AND CONQUER, TRANSFORM AND CONQUER								22ISE52.2 22ISE52.6			8 Hours			
Divide and Conquer: General method-Recurrence equation for divide and conquer-Analysis of quick sort and merge sort algorithm- Advantages and disadvantages of divide and conquer approach. Decrease and Conquer: General Method, Topological sorting. Transform and Conquer: General Method, Heaps and Heap Sort															
Text Book		Text Book 1: 4.2,5.1,5.2,6.4													
MODULE-3	GREEDY APPROACH, DYNAMIC PROGRAMMING								22ISE52.3 22ISE52.6			8 Hours			
Greedy Approach: General method, Prim’s Algorithm, Kruskal’s Algorithm, Single source shortest paths: Dijkstra’s Algorithm, 0/1 Knapsack problem. Dynamic Programming: General method, All pair shortest path problem, Longest common subsequence, Traveling salesperson problem															
Text Book		Text Book 1:8.1,8.4,9.1,9.2,9.3, Text Book 2:5.9													
MODULE-4	BACKTRACKING, BRANCH AND BOUND, CLASSES OF COMPUTATIONAL COMPLEXITY								22ISE52.3 22ISE52.4 22ISE52.6			8 Hours			
Backtracking: General method, N-Queens problem, Sum of subsets problem. Branch and Bound: General method, Travelling Sales Person problem, Knapsack problem															

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

- NPTEL course
- Contents related activities (Activity-based discussions)
- Problem Solving Exercises
- For active participation of students, instruct the students to solve and analyze various algorithms

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Course Code	22ISL52	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	2	Total Marks	100
Credits	01	Exam Hours	03

Course outcomes:

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

22ISL52 .1	Examine the problems using brute force, divide and conquer and decrease and conquer techniques.
22ISL52 .2	Analyze the problems using greedy and dynamic programming techniques.
22ISL52 .3	Investigate the problems using backtracking and online approaches.
22ISL52 .4	Analyze the different string-matching algorithms.

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISL52 .1	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL52 .2	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL52 .3	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL52 .4	3	3	3	2	3	-	-	-	-	-	-	1	3	3

Pgm. No.	List of Programs	Hours	COs
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Prerequisite Programs

	Expected Prior Knowledge and Skills: Proficiency in a C & C++ programming language, basic program design concepts (e.g, pseudo code), proof techniques, familiarity with trees and graph data structures, familiarity with basic algorithms such as those for searching, and sorting, knowledge of Discrete Structures as minimum cost spanning trees.	2	NA
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PART-A

1	Implement and analyze quick sort algorithm.	2	22ISL52 .1
2	Implement and analyze merge sort algorithm	2	22ISL52 .1
3	Implement and analyze topological sorting in a given directed graph.	2	22ISL52 .1
4	Implement and analyze Kruskal's algorithm and find minimum cost spanning tree of a given connected undirected graph.	2	22ISL52 .2
5	Implement and analyze Prim's algorithm and find minimum cost spanning tree of a given connected undirected graph.	2	22ISL52 .2
6	Implement and analyze Dijkstra's algorithm to find the shortest path from a given source.	2	22ISL52 .2

PART-B

7	Implement travelling salesman problem using dynamic programming.	2	22ISL52 .2
8	Implement 0/1 Knapsack problem.	2	22ISL52 .2

9	Implement N-Queens problem using backtracking.	2	22ISL52 .3
10	Implement sum of subset problem using backtracking.	2	22ISL52 .3
11	Implement and compare Simple string matching and KMP string matching algorithm.	2	22ISL52 .4
12	Implement and analyze k-server Problem	2	22ISL52 .3

PART-C

Beyond Syllabus Virtual Lab Content

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

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

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

- 1) Cormen T.H., Leiserson C.E., Rivest R.L., Stein C, “Introduction to Algorithms”, 4th Edition, The MIT Press, 2022
- 2) Anany Levitin , “Introduction to the Design and Analysis of Algorithms,3rd Edition,Pearson, 2012
- 3) Ellis Horowitz, Satraj Sahni and Rajasekaran, “Computer Algorithms/C++”, 2nd Edition, Universities Press, 2014

DATA SCIENCE

Course Code	22ISE53	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:

22ISE53.1	Understand the probability, Statistics and Linear algebra concepts essential for data science.
22ISE53.2	Model the real –world data set and apply algebraic and geometric view for the data.
22ISE53.3	Apply linear regression and multiple linear regression for model building and prediction.

22ISE53.4	Develop the classification model using classification algorithms.													
22ISE53.5	Develop the clustering model using clustering algorithms.													
22ISE53.6	Model the real world datasets and apply optimization techniques.													
Mapping of Course Outcomes to Program Outcomes and Program-Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE53.1	3	3	3	3	2	2	-	-	-	-	1	2	3	2
22ISE53.2	3	3	3	3	3	2	-	-	-	-	1	2	3	2
22ISE53.3	3	3	3	3	2	2	-	-	-	-	1	2	3	2
22ISE53.4	3	3	3	3	3	2	-	-	-	-	1	2	3	2
22ISE53.5	3	3	3	3	3	2	-	-	-	-	1	2	3	2
22ISE53.6	3	3	3	3	3	2	-	-	-	-	1	2	3	2
MODULE-1	FOUNDATIONS OF DATA SCIENCE									22ISE53.1			8 Hours	
Introduction to data science, Data mining and Data Warehousing, Descriptive analytics, Probability Theory, Probability distribution, Confidence interval Hypothesis Testing														
Text Book			Text Book 1: Ch 1 Text Book 2: Ch 1											
MODULE-2	DATA PREPROCESSING									22ISE53.2			8 Hours	
Types of Data, Sampling Theory, Correlation, Feature selection, Dimensionality reduction techniques: Projections, Eigen value decomposition, Principal component Analysis(PCA)														
Text Book		Text Book 1: Ch 4, Ch 5, Ch 8, Ch 10 Text Book 2: Ch 3												
MODULE-3	LINEAR REGRESSION									22ISE53.3			8 Hours	
Simple Linear Regression - Steps in Building a Regression Model, Model Diagnostics, Multiple Linear Regression - Developing Multiple Linear Regression, Model , Multi collinearity, Residual analysis, Detecting Influencers														
Self-study / Case Study / Applications		Examine the Use Case for Customer Personality Analysis. Identify the way to analyze the effectiveness of a new LinkedIn chat feature that shows a “green dot” for active users.												
Text Book		Text Book 1: Ch 9, Ch 10												
MODULE-4	CLASSIFICATION									22ISE53.4			8 Hours	
Logistic regression, Naive Bayes, K Nearest Neighbor, Decision Trees, Random Forest, Model diagnostics														
Self-study / Case Study/ Applications		Illustrate the measures to calculate the success of private stories on Instagram, where only certain close friends can see the story. Estimate the Use Case considering Home furniture’s is the top selling category.												
Text Book		Text Book 1: Ch 11, Ch 12 Text Book 2: Ch 8												
MODULE-5	CLUSTERING AND OPTIMIZATION									22ISE53.5, 22ISE53.6			8 Hours	
Clustering techniques- K Means, Hierarchical clustering, DB SCAN, Jaccard coefficient, Gower's Index, Elbow technique, Silhouette's coefficient, Optimization for Data Science														
Text Book		Text Book 1: Ch 14												

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	10	5	5
L3	Apply	5	5	5
L4	Analyze	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) U Dinesh Kumar, “Business Analytics :The Science of Data Driven decision making”, First Edition, Wiley Publishers, 2017.
- 2) Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning using Python”, First Edition, Wiley Publishers, 2019.
- 3) Gilbert Strang, “Introduction to Linear Algebra, Fifth Edition”, Wellesley-Cambridge Press and SIAM, 2016.

Reference Books:

- 1) Bruce M King, Edward W Minium , “Statistical Reasoning in the Behavioral Sciences”, 5th Edition, Wiley Publishers, 2018
- 2) Douglas C. Montgomery, Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 6th Edition, Wiley Publishers, 2016

Web links and Video Lectures (e-Resources):

- <https://machinelearningmastery.com/>
- <https://towardsdatascience.com/data-science/home>
- https://spoken-tutorial.org/tutorialsearch/?search_foss=Python+3.4.3&search_language=English
- https://onlinecourses.nptel.ac.in/noc20_cs46/preview

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

- Demonstrate the need of statistics and probability for data science to students.
- Demonstration of Jupyter notebook for hands-on experience with datasets.
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to understand real-world datasets and various optimization techniques.
 - Organizing Group wise discussions on issues
 - Seminars

DATA SCIENCE LABORATORY														
Course Code	22ISL53							CIE Marks			50			
L:T:P:S	0:0:1:0							SEE Marks			50			
Hrs / Week	2							Total Marks			100			
Credits	1							Exam Hours			03			
Course outcomes:														
At the end of the course, the student will be able to:														
22ISL53.1	Understand basic operations of NumPy, Pandas, and Matplotlib.													
22ISL53.2	Implement Regression models for the sample datasets.													
22ISL53.3	Develop Classification models and optimize the performance.													
22ISL53.4	Develop clustering models and apply on suitable datasets.													
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
22ISL53.1	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL53.2	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL53.3	3	3	3	2	3	-	-	-	-	-	-	1	3	3
22ISL53.4	3	3	3	2	3	-	-	-	-	-	-	1	3	3
Pgm. No.	List of Programs											Hours	COs	
Prerequisite Programs														
	- Mathematics, like probability, statistics and calculus - Object- oriented programming languages like java, C, Python - Structured Query Language(SQL) for database queries											2	NA	
PART-A														
1	Using pandas in python demonstrate the following operations for the sample dataset given, 1) Indexing of Data frame 2) Grouping and aggregating 3) Adding and removing attributes 4) Joining data frames 5) Filtering the data 6) Handling missing values.											2	22ISL53.1	
2	Using pandas and Matplotlib demonstrate the following 36 operations for the sample dataset given, i) Bar chart and Histogram ii) Comparing Distribution iii) Box plot and mention quartiles.											2	22ISL53.1	
3	Using Numpy, pandas and Matplotlib demonstrate the following operations for the sample dataset given, i) Central tendency ii) Dispersion and Distribution iii) ANOVA iv) Hypothesis testing											2	22ISL53.1	
4	Develop a program to implement Simple Linear Regression model and evaluate the model by verifying the performance.											2	22ISL53.2	
5	Develop a program to implement Multiple Linear Regression model and evaluate the model by verifying the performance.											2	22ISL53.2	
6	Develop a program to implement Logistic Regression and indicate the class label for the test dataset											2	22ISL53.2	

PART-B			
7	Develop a program to implement Naive Bayes classifier model and analyze the model using confusion matrix	2	22ISL53.3
8	Develop a program to implement Decision Tree model and analyze the model using confusion matrix.	2	22ISL53.3
9	Develop a program to implement Random Forest classifier model and analyze the model using confusion matrix.	2	22ISL53.3
10	Develop a program to implement KNN classifier model and analyse the model using confusion matrix.	2	22ISL53.3
11	Develop a program to implement K Means clustering model for the given value of K, where K is number of clusters.	2	22ISL53.4
12	Develop a program to implement Hierarchical clustering model for the given value of N, where N is number of clusters.	2	22ISL53.4
PART-C			
Beyond Syllabus Virtual Lab Content			
(To be done during Lab but not to be included for CIE or SEE)			
https://cpe-iitg.vlabs.ac.in/exp/serial-position-effect/			
CIE Assessment Pattern (50 Marks – Lab)			
RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	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	10	
L4	Analyze	20	
L5	Evaluate	10	
L6	Create	-	
Suggested Learning Resources:			
Reference Books:			
1. U Dinesh Kumar, “Business Analytics :The Science of Data Driven decision making”, First Edition, Wiley Publishers, 2017.			
2. Jiawei Han , Micheline Kamber , Jian Pei Professor, “Data Mining: Concepts and Techniques”, Third Edition, Morgan Kaufmann Series,2011.			

INFORMATION THEORY AND CODING														
Course Code	22ISE541								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:														
22ISE541.1	Understand the basics of information theory and channel capacity.													
22ISE541.2	Apply different source coding techniques													
22ISE541.3	Understand the notation and concepts of error control coding.													
22ISE541.4	Apply linear block codes for error detection and correction.													
22ISE541.5	Implementation of cyclic codes, BCH and RS for channel coding.													
22ISE541.6	Analysis of error detection and correction properties of convolution code.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE541.1	3	3	2	2	1	-	-	-	-	-	1	1	3	3
22ISE541.2	3	2	3	1	1	-	-	-	-	-	1	1	3	3
22ISE541.3	3	3	3	2	1	-	-	-	-	-	1	1	3	3
22ISE541.4	3	3	3	2	1	-	-	-	-	-	1	1	3	3
22ISE541.5	3	3	3	2	1	-	-	-	-	-	1	1	3	3
22ISE541.6	3	3	3	2	1	-	-	-	-	-	1	1	3	3
MODULE-1	INFORMATION THEORY								21ISE541.1 21ISE541.2		8 Hours			
Entropy, Information rate, lossless source coding, source entropy rate: Shannon-Fano and Huffman coding techniques, mutual Information, channel capacity of discrete channel, Shannon- Hartley law, trade-off between bandwidth and SNR														
Text Book	Text Book 1: Ch 4													
MODULE-2	ERROR CONTROL CODES								21ISE541.3		8 Hours			
Introduction, basic notations, coding gain, characterization of error control codes, performance of error control codes, comparison of uncoded and coded systems														
Text Book	Text Book 1: Ch 9													
MODULE-3	LINEAR BLOCK CODES								21ISE541.4		8 Hours			
Linear block codes and their properties, standard arrays, syndromes, weight distribution. error detection and correction properties modified linear block codes														
Text Book	Text Book 1: Ch 9													
MODULE-4	BINARY CYCLIC CODES								21ISE541.5		8 Hours			
Algebraic structure of cyclic codes, encoding using an (n-k) bit shift register, syndrome calculation, error detection and correction, introduction to BCH and RS Codes, Hamming weight, Hamming distance														
Text Book	Text Book 1: Ch 9													
MODULE-5	CONVOLUTION CODES								21ISE541.6		8 Hours			
Minimal polynomial encoding and decoding, Convolution encoders, Structural properties of convolution codes, trellis diagrams, Viterbi algorithm, and performance analysis.														
Text Book	Text Book 1: Ch 9													
CIE Assessment Pattern (50 Marks – Theory)														
RBT Levels								Marks Distribution						
				Test (s)				AAT1						
				25				25						
L1	Remember			5				-						
L2	Understand			10				5						
L3	Apply			5				5						

L4	Analyze	5	5	
L5	Evaluate	-	10	
L6	Create	-	-	
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Exam Mark Distribution		
L1	Remember	10		
L2	Understand	20		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1. K. Sam Shanmugam, John , "Digital and analog communication systems", Wiley India Pvt.Ltd, 1996.				
Reference Books:				
1. John Proakis, "Digital Communications", TMH, 5th Ed., 2008.				
2. Information Theory and Coding, Hari Bhat, Ganesh Rao, Cengage, 2017.				
3. Andre Neubauer, "Coding Theory: Algorithms, Architectures & Applications", Wiley Publications, 2010.				
4. Kennedy, "Electronic Communication systems", McGraw Hill, 4th Ed., 1999				
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
• Video demonstration of latest topics in Information Theory and Coding. • Contents related activities (Activity-based discussions) • For active participation of students, instruct the students to prepare PPT and present in class • Organizing Group wise discussions on issues • Seminars				

PRINCIPLES OF CLOUD COMPUTING														
Course Code	22ISE542							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:														
22ISE542.1	Compare the strengths and limitations of cloud computing													
22ISE542.2	Identify the architecture, infrastructure and delivery models of cloud computing													
22ISE542.3	Demonstrate the working of VM and VMM on any cloud platforms(public/private)													
22ISE542.4	Examine the cloud services, Applications and Virtualization													
22ISE542.5	Analyze the different Storage Technology													
22ISE542.6	Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
22ISE542.1	3	2	1	-	-	-	-	-	-	-	-	2	2	3
22ISE542.2	2	2	1	-	-	-	-	-	-	-	-	2	2	3
22ISE542.3	2	2	1	-	-	-	-	-	-	-	-	2	2	3

22ISE542.4	3	2	1	-	-	-	-	-	-	-	-	2	2	3
22ISE542.5	3	3	1	-	-	-	-	-	-	-	-	2	2	3
22ISE542.6	3	3	1	-	-	-	-	-	-	-	-	2	2	3
MODULE-1	INTRODUCTION TO CLOUD COMPUTING										22ISE542.1		8 Hours	
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities.														
Case study			Compare the three cloud computing delivery models, SaaS, PaaS, and IaaS, from the point of view of application developers and users. Discuss the security and the reliability of each model. Analyze the differences between PaaS and IaaS.											
Text Book			Text Book 1: Ch 1											
MODULE-2	CLOUD COMPUTING PLATFORM										22ISE542.2		8 Hours	
Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Edge Computing: Basic characteristics and attributes, Edge and real time, Benefits of Edge computing, Fog computing: Basic characteristics, Difference between Edge and Fog computing.														
Self-study		Compare the Oracle Cloud offerings (see https://cloud.oracle.com) with the cloud services provided by Amazon, Google, and Microsoft, User Experience, Software Licensing.												
Text Book		Text Book 1: Ch 3												
MODULE-3	CLOUD VIRTUALIZATIONS										22ISE542.3, 22ISE542.4		8 Hours	
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and para virtualization														
Case Study		Case Study: Xen a VMM based para virtualization												
Text Book		Text Book 1: Ch 5												
MODULE-4	CLOUD STORAGE SYSTEM										22ISE542.5		8 Hours	
Storage Systems - The Evolution of Storage Technology, Storage Models, File Systems, and Databases, Distributed File Systems: The Precursors, General Parallel File System, Google File System														
Self Study		Analyze the advantage of memory-based check pointing.												
Text Book		Text Book 1: Ch 8												
MODULE-5	CLOUD SECURITY										22ISE542.6		8 Hours	
Cloud Security, Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization														
Case Study		Compare the benefits and the potential problems due to virtualization on public, private, and hybrid clouds.												
Text Book		Text Book 1: Ch 9												
CIE Assessment Pattern (50 Marks – Theory)														
RBT Levels		Marks Distribution												
		Test (s)		AAT1										
		25		25										
L1	Remember	5		-										
L2	Understand	5		5										
L3	Apply	5		5										
L4	Analyze	5		5										
L5	Evaluate	5		10										
L6	Create	-		-										

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:**Text Books:**

1. Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2022.
2. Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2016.

Reference Books:

1. Cloud Computing :A Complete Guide , Gerardus Blokdyk, 5STARCook Publisher, 2020 Edition
2. Definitive guide to Cloud Computing, Shargunam .S, R. Mallika Pandeewari, R. Ravi Ramaraj, Noorr Publisher, 2021 ISBN: 978-620-3-85790-0

Web links and Video Lectures (e-Resources):

- <https://www.javatpoint.com/cloud-computing-tutorial>
- https://www.tutorialspoint.com/cloud_computing/index.html
- <https://www.digimat.in/nptel/courses/video/106105167/L01.html> (Video Lectures)

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

- Video demonstration of latest trends in Cloud Computing
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare PPT and Present in class
 - Organizing Group wise discussions on issues
 - Seminars

COMPILER DESIGN

Course Code	22ISE543	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:

22ISE543.1	Understand the appropriate machine for recognition of that language.
22ISE543.2	Analyse machine to grammar and vice versa.
22ISE543.3	Analyze Top-Down Paring Techniques
22ISE543.4	Apply Bottom-Up Parsing Techniques
22ISE543.5	Design various Code Optimization Techniques and Error Recovery Mechanisms
22ISE543.6	Apply the different Concepts in Compiler Design.

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
22ISE543.1	3	3	3	2	-	-	-	-	-	-	-	-	3	3
22ISE543.2	3	3	3	2	-	-	-	-	-	-	-	-	3	3
22ISE543.3	3	3	3	2	-	-	-	-	-	-	-	-	3	3
22ISE543.4	3	3	3	2	-	-	-	-	-	-	-	-	3	3
22ISE543.5	3	3	3	2	-	-	-	-	-	-	-	-	3	3
22ISE543.6	3	3	3	2	-	-	-	-	-	-	-	-	3	3
MODULE-1	INTRODUCTION TO THEORY OF COMPUTATION									22ISE543.1 & 22ISE543.2			8 Hours	
Preliminaries - Sets, operations, relations, transitive closure, count ability and diagonalization, induction and proof methods- pigeon-hole principle and simple applications - concept of language - grammars and production rules - Chomsky hierarchy.														
Self-study / Case Study /Applications	Write a case study on Chomsky hierarchy.													
Text Book	Text Book 1: Ch 1.1 TO 1.5 , Ch 3.1 to 3.4 & Text Book 2: Ch1													
MODULE-2	REGULAR GRAMMARS									22ISE543.2& 22ISE543.3			8 Hours	
Regular grammars, deterministic finite automata - non determinism, conversion to deterministic automata- e-closures, regular expressions, finite automata, regular sets.														
Self-study / Case Study /Applications	Explain about Regular grammars in finite automata.													
Text Book	Text Book 1: Ch 3.4 to 3.9 Ch 4.1 to 4.4													
MODULE-3	SYNTAX ANALYSIS-II									22ISE543.4			8 Hours	
Syntax Analysis II: Bottom-up Parsing, Operator Precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators.														
Self-study / Case Study /Applications	Illustrate the concept of Operator Precedence Parsing with an example.													
Text Book	Text Book 2: Ch 4.5 to 4.9													
MODULE-4	SYNTAX-DIRECTED TRANSLATION									22ISE543.5			8 Hours	
Syntax Directed Translation: Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L Attributed Definitions, syntax directed definitions and translation schemes.														
Self-study / Case Study /Applications	Examine Construction of Syntax Trees.													
Text Book	Textbook 2: Ch 5.1 to 5.4													

MODULE-5	INTERMEDIATE CODE GENERATION	22ISE543.5 & 22ISE543.6	8 Hours
Intermediate Code Generation: Variants of Syntax trees, Three-Address Code, Types & Declarations, type checking, Control Flow, Data Flow Algorithms-Issues in Design of a Code Generator - The Target Language, Addresses in the Target Code, A Simple Code Generator Algorithm.			
Self-study / Case Study /Applications	Interpret a Simple Code Generator Algorithm.		
Text Book	Textbook 3: 6.1 to 6.6 Ch. 8.4 & 8.6		
CIE Assessment Pattern (50 Marks - Theory) -			
RBT Levels		Marks Distribution	
		Test (s) (25)	AAT1 (25)
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	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. Martin John, “Introduction to languages and the theory of computation”, TMH			
2. Motwani Hopcroft, Ullman, “Introduction to Automata Theory, Languages and computation”, Pearson Education.			
3. Aho, Lam, Sethi, and Ullman , “Compilers: Principles, Techniques and Tools”, Pearson, 2 nd Edition, 2014			
Web links and Video Lectures (e-Resources):			
• https://onlinecourses.nptel.ac.in/noc21_cs07/preview			
• https://nptel.ac.in/courses/106105190			
• https://nptel.ac.in/courses/106104123			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning			
➤ For active participation of students, instruct the students to prepare for puzzles and presentations.			
➤ Discussions on applications of Finite Automata , Compiler Design			

OPERATION RESEARCH														
Course Code	22ISE544								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:														
22ISE544.1	Realize the importance of Operations Research and explain the basic concepts ☐													
22ISE544.2	Construct and Solve Linear Programming Problems for its optimal solutions by graphical method													
22ISE544.3	Apply the concept of Simplex method and its extensions to Solve Linear Programming Problems for its optimal solutions													
22ISE544.4	Solve specialized linear programming problems like assignment problems using various OR methods													
22ISE544.5	Solve the problem of transporting the products from origins to destinations with least transportation cost.													
22ISE544.6	Analyze network technique namely PERT/CPM and optimal project duration and cost													
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
22ISE544.1	2	2	1	-	-	-	-	-	-	-	-	1	2	2
22ISE544.2	2	2	1	-	-	-	-	-	-	-	-	1	2	2
22ISE544.3	2	2	1	-	-	-	-	-	-	-	-	1	2	2
22ISE544.4	2	2	1	-	-	-	-	-	-	-	-	1	2	2
22ISE544.5	2	2	1	-	-	-	-	-	-	-	-	1	2	2
22ISE544.6	2	2	1	-	-	-	-	-	-	-	-	1	2	2
MODULE-1	INTRODUCTION & LINEAR MODEL-I:								22ISE544.1, 22ISE544.2			8Hours		
Definition and Historical development of OR, Nature and Meaning of OR, Characteristics of OR, Phases of OR, Scope of OR. Introduction to Linear Model, Formulation of LPP problem, Graphical Solution, standard form of LPP														
Self-study			Investigate a linear programming problem using graphical method											
Text Book			Text Book 1: Unit 1-Ch:2,Unit 2-Ch:3											
MODULE-2	LINEAR MODEL-II:								22ISE544.3			8 Hours		
Computational procedure of simplex method, Degeneracy problem, method to resolve degeneracy. Special cases: Alternative optimum solution, unbounded solution, Big-M method, Concept of duality														
Text Book		Text Book 1: Unit 2-Ch:5,Ch:7												
MODULE-3	ASSIGNMENT MODEL:								22ISE544.4			8 Hours		
Introduction, Mathematical formulation of assignment problem, Hungarian method to solve assignment problems, unbalanced assignment problems, maximal assignment problem, restriction on assignments, travelling salesman problem														
Self-study		Investigate Assignment Problem using Hungarian Method												
Text Book		Text Book 2: Unit 2-Ch 16												
MODULE-4	TRANSPORTATION MODEL:								22ISE544.5			8 Hours		
Introduction, Mathematical formulation of transportation problem, definitions, initial basic feasible solution, moving towards optimality, Transportation Algorithm for minimization (MODI method) unbalanced transportation problem.														
Text Book		Text Book 1: Unit 2-Ch 15												

MODULE-5	NETWORK ANALYSIS:	21ISE544.6	8 Hours
Introduction to Project management, basic steps in PERT / CPM techniques, network diagram representations and rules, Time estimates and Critical Path in Network Analysis, Optimum duration and Minimum duration cost, Project Evaluation and Review Technique (PERT), Applications			
Text Book	Text Book 1: Unit 4-Ch 31		
CIE Assessment Pattern (50 Marks – Theory)			
RBT Levels		Marks Distribution	
		Test (s)	AAT1
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	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) S. D. Sharma, “OPERATIONS RESEARCH – Theory, Methods & Applications”, , Seventeenth Review Edition 2014, Reprint 2015, Kedarnath Ram Nath Publisher			
Reference Books:			
1) Frederick S Hillier, Gerald J Lieberman, Bodhibrata Nag and Preetam Basu “Introduction to OPERATIONS RESEARCH ”, , Ninth Edition, Tenth Reprint , 2015, TATA McGraw Hill			
2) Hamdy Taha, “Operations Research: An Introduction”, Pearson Education Inc. (2009)			
Web links and Video Lectures (e-Resources):			
• https://onlinecourses.nptel.ac.in/noc22_ma48/preview • https://www.udemy.com/course/operations-research- • https://www.coursera.org/learn/operations-research-modeling • https://www.coursera.org/learn/operations-research-theory			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning			
• Quizzes • 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			

ADVANCED JAVA														
Course Code	22ISE545								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:														
22ISE545.1	Analyze the importance of event-based programming in Java.													
22ISE545.2	Make use of JDBC to access database through Java Programs													
22ISE545.3	Apply servlet technologies to build server-side applications.													
22ISE545.4	Develop JSP based server-side solutions.													
22ISE545.5	Build web-based software components to solve real world problems.													
22ISE545.6	Interpret the importance of Spring frame works in enterprise software solutions.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE545.1	3	3	3	2	2	-	-	-	1	-	-	1	2	2
22ISE545.2	3	3	3	2	2	-	-	-	1	-	-	1	2	2
22ISE545.3	3	3	3	2	2	-	-	-	1	-	-	1	2	2
22ISE545.4	3	3	3	2	2	-	-	-	1	-	-	1	2	2
22ISE545.5	3	3	3	2	2	-	-	-	1	-	-	1	2	2
22ISE545.6	3	3	3	2	2	-	-	-	1	-	-	1	2	2
MODULE-1	INTRODUCTION TO EVENT HANDLING								22ISE545.1			8 Hours		
Event driven programming in Java, Event handling Process, Swing Controls and UI elements,The Delegation Event Model, Swing Event Classes, Event Sources, Event Listener, Adapter Classes.														
Text Book			Text Book 1: Chapter 24											
MODULE-2	WORKING WITH JDBC								22ISE545.2			8 Hours		
Exploring web architecture models, Exploring the MVC architecture, Introducing JDBC, Exploring JDBC Drivers, Describing JDBC APIs, Exploring JDBC processes with java. sql package														
Text Book			Text Book 2: Chapter 6											
MODULE-3	WORKING WITH SERVLETS								22ISE545.3			8 Hours		
Http protocol, Exploring the features of java servlets, Exploring the servlets API, Servlets life cycle, Working with the Http servlets request and Http servlets response interfaces, Exploring request delegation and request scope														
Text Book			Text Book 2: Chapter 10											
MODULE-4	WORKING WITH JAVA SERVER PAGES								22ISE545.4 22ISE45.5			8 Hours		
Introducing JSP, Listing advantages of JSP over java servlets, Exploring the architecture of a JSP page, Describing the life cycle of a JSP page, Working with JSP basic tags and implicit objects, Working with the action tags in JSP Case Study/Application: Demonstrate the learnt concept of JSP and Servlets to develop a web registration module and integrate with Database using JDBC. A three tier based application needs to be developed and presented as case study.														
Text Book			Text Book 2: Chapter 11											
MODULE-5	INTRODUCTION TO SPRING FRAMEWORK								22ISE545.6			8 Hours		
Introduction to Spring framework, Benefits ,Spring Architecture, Components, Bean Life Cycle, XML Configuration on Spring, Spring Model View Controller (MVC)														

Text Book

Text Book 3: Chapter 1

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	AAT1
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	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. Herbert Schildt, “JAVA the Complete Reference”, 11thEdition, Tata McGraw Hill, 2020 (print).

2. JimKeogh,“J2EE- The Complete Reference”, McGraw-Hill,2017.

3. Rod Johnson, “Professional Java Development with the Spring Framework”, Wrox ,July 2018(Re-print)

Reference Books:

1. Stephanie Bodoff et al, “The J2EE Tutorial”, 3rd Edition, Pearson Education,2015(Reprint).

2. Uttam K Roy, “Advanced JAVA programming”, Oxford University press, 2018.

Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc22_cs47/preview

<https://www.udemy.com/course/how-to-connect-java-jdbc-to-mysql/>

<https://www.javatpoint.com/html-tutorial>

https://www.geeksforgeeks.org/life-cycle-of-a-servlet/?ref=ml_lbp

https://www.youtube.com/results?search_query=java+jdbc+connection

<https://spring.io/projects/spring-framework>

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

➤ Create Dynamic web projects by using JDBC drivers.

➤ Contents related activities (Activity-based discussions)

➤ Organizing Group wise discussions on issues

➤ Seminars

DEVOPS														
Course Code	22ISE546								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:														
22ISE546.1	Understand DevOps as a practice, methodology and process for fast collaboration, integration and communication between Development and Operations team.													
22ISE546.2	Understand common Infrastructure Servers, Availability and Scalability													
22ISE546.3	Describe AWS DevOps is used for Identity Access Management.													
22ISE546.4	Understand the requirements of Configuration Management using Ansible													
22ISE546.5	Understand Docker Containerization, Micro service Architecture													
22ISE546.6	Implement the Orchestration and Automation tool -Kubernetes													
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
22ISE546.1	3	3	3	3	3	2	-	2	2	-	3	2	3	2
22ISE546.2	3	3	3	3	3	2	-	2	2	-	3	2	3	2
22ISE546.3	3	3	3	3	3	2	-	2	2	-	3	2	3	2
22ISE546.4	3	3	3	3	3	2	-	2	2	-	3	2	3	2
22ISE546.5	3	3	3	3	3	2	-	2	2	-	3	2	3	2
22ISE546.6	3	3	3	3	3	2	-	2	2	-	3	2	3	2
MODULE-1	INTRODUCTION TO DevOps								22ISE546.1, 22ISE546.2			8 Hours		
Introduction to DevOps: History of DevOps ,Dev and Ops, DevOps definitions, DevOps and Software Development Life Cycle, DevOps &Main objectives, Concepts of Cloud and Virtualization, Historyand Evolution of cloud, Cloud computing concepts, Characteristics and Benefits of Cloud, Cloud Servicemodels, IaaS, PaaS and SaaS, Virtualization, Virtual Machines vs Containers.														
Text Book			Text Book 1: Chapter 24											
MODULE-2	AWS DevOps								22ISE546.3			8 Hours		
AWS DevOps. Identity Access Management., S3, Glacier and CloudFront., EC2, Route53, Databases on AWS, VPC, Deployment with EC2 and Auto Scaling. AWSDeveloper Tools, CodeStar, CodeCommit, CodeBuild, CodeDeploy, CodePipeline														
Text Book		Text Book 2: Chapter 6												
MODULE-3	SCM Tools								22ISE546.4			8 Hours		
SCM Tools (Git&GitHub, Bitbucket), Introduction to Version Control , Configuring Git Profile on the local machine , Git Commands and Repository, Branching , Workingwith GitHub														
Introduction to Ansible, Introduction to YAML ,Ansible Documentation , Setup andConfiguration , Ansible Playbooks ,Ansible Command line ,Ansible Modules , Ansible Command Line Usage, Ansible Roles ,Ansible Galaxy Cases: Real Time & PracticalScenarios of Playbook														
Text Book		Text Book 2: Chapter 10												
MODULE-4	Containers - Docker								22ISE46.5			8 Hours		
Containers - Docker ,Docker Concepts , Installing Docker, Managing Docker Images, Build Docker Images by using Docker Commands & DockerFile, Push Docker Images to Docker Hub, Docker Networking, Links and Volumes Cases: Real Time & PracticalScenarios														
Text Book		Text Book 2: Chapter 11												

MODULE-5	Orchestration and Automation -Kubernetes	22ISE546.6	8 Hours
Orchestration and Automation -Kubernetes, K8S Concepts, Installing Kubernetes,Creating Clusters with Kubernetes, Managing and Administering Cluster via Kubernetes Cases: Real-time Implementation. Jenkins , Continuous Integration with Jenkins Overview			
Text Book	Text Book 3: Chapter 1		
CIE Assessment Pattern (50 Marks – Theory)			
RBT Levels		Marks Distribution	
		Test (s)	AAT1
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	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. The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win, by Gene Kim (Author), Kevin Behr (Author), George Spafford ,Kindle Edition,Oct 2014			
2. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation (Addison-Wesley Signature Series (Fowler) by Jez Humble (Author), David Farley,1st Edition ,July 2010.			
REFERENCE BOOKS:			
1. DevOps for Developers Authors: Httermann, Michael, Publisher-Apress,1st Edition ,July 2010.			
2. The Visible Ops Handbook: Implementing ITIL in 4 Practical and Auditable Steps Kindle Editionby <u>Gene Kim</u> (Author), <u>George Spafford</u> (Author), <u>Kevin Behr</u> ,Publisher : IT Process Institute, Inc.; Revised First Edition (15 June 2015)			
3. The Goal: A Process of Ongoing Improvement Kindle Editionby <u>Eliyahu M. Goldratt</u> (Author), <u>Jeff Cox</u> ,North River Press; 3rd edition (June 1, 2012)			
Web links and Video Lectures (e-Resources):			
1. http://dev2ops.org/			
2. https://devopsdays.org/			
3. https://dzone.com/devops-tutorials-tools-news			
4. https://spoken-tutorial.org/tutorial-search/?search_foss=Git&search_language=English			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning			
➤ Contents related activities (Activity-based discussions)			
➤ Organizing Group wise discussions on issues			
➤ Seminars			

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)	AAT1	AAT2
		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://spoken-tutorial.org/tutorialsearch/?search_foss=LaTeX&search_language=English
- <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	2							Total Marks	50			
Credits	1							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	1						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:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P0100	P011	P012
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	3 hours			
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	3 hours			
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	3 hours			
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	3 hours			
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	3 hours			
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 / Applications		Department Specific Self-study / Case Study / Applications can be added.										
Text Book		Text Book 1: Ch. 7										
CIE Assessment Pattern (50 Marks – Theory) –												
RBT Levels		Marks Distribution										
		Test (s)	AAT1					AAT2				
		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	22ISE58	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	0	Total Marks	100
Credits	01	Exam Hours	03

Course outcomes:

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

22ISE58.1	Analyze the Real-world problem through survey of existing problems
22ISE58.2	Design the modules for solving the problems identified
22ISE58.3	Implement the design modules with suitable programming language
22ISE58.4	Test and present the working modules at different levels and prepare reporting as a team

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
22ISE58.1	3	3	3	2	3	-	1	1	3	1	3	2	3	3
22ISE58.2	3	3	3	2	3	-	1	1	3	1	3	2	3	3
22ISE58.3	3	3	3	2	3	-	1	1	3	1	3	2	3	3

22ISE58.4	3	3	3	2	3	-	2	1	3	1	3	2	3	3
Mapping of Course Outcomes to Program Specific Outcomes: Use C, C++, Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated ondesktop/laptop as a stand-alone or web based application. Note : • Every student should do mini project in a team consists of maximum 2 members in the areas suggestedby the department expert committee • Minimum 2 reviews will be conducted by the department expert committee to know the progress of themini project work • In each review student should give presentation on the work carried out and show the relevant models/output • A mini project report should be submitted to the department at the end of the mini project work • Plagiarism check for the report : Similarity index of the report should not exceed more than 30%.														
CIE Assessment Pattern (50 Marks – Theory) –														
RBT Levels		Exam Marks Distribution (50)												
L1	Remember	-												
L2	Understand	-												
L3	Apply	10												
L4	Analyze	10												
L5	Evaluate	15												
L6	Create	15												
SEE Assessment Pattern (50 Marks – Theory)														
RBT Levels		Exam Marks Distribution (50)												
L1	Remember	-												
L2	Understand	-												
L3	Apply	10												
L4	Analyze	10												
L5	Evaluate	15												
L6	Create	15												

NATIONAL SERVICE SCHEME (NSS)			
Course Code	22NSS30, 22NSS40, 22NSS50, 22NSS60	CIE Marks (each Semester)	50
L:T:P:S	0:0:0:0	SEE Marks	--
Hrs / Week	2	Total Marks	50 x 4 = 200
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:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
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
3 RD 22NSS30	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.									22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4		30 HRS
4 TH 22NSS40	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.									22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4		30 HRS
5 TH 22NSS50	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. 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 development programs etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).									22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4		30 HRS
6 TH 22NSS60	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. 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, Indian Agriculture (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 Govt organization, 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 contribution in 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 to achieve 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/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 rural outreach programs. (minimum5 programs)	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
10.	Organize National integration and social harmony events / workshops / seminars. (Minimum 02	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

	programs).					
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	22PED30, 22PED40, 22PED50, 22PED60						CIE Marks (each semester)			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 4= 200		
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:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
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	
3 RD 22PED30	Module 1: Orientation A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.								22PED30.1, 22PED30.2		5 HRS	
	Module 2: General Fitness & Components of Fitness A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach								22PED30.2, 22PED30.3		15 HRS	

	F. Cardiovascular Endurance – Harvard step Test		
	Module 3: Recreational Activities A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.	22PED30.3, 22PED30.4	10 HRS
	Module 1: Ethics and Moral Values A. Ethics in Sports B. Moral Values in Sports and Games	22PED40.1, 22PED40.2	5 HRS
4 TH 22PED40	Module 2: Specific Games (Anyone to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.	22PED40.3	20 HRS
	Module 3: Role of Organization and administration	22PED40.4	5 HRS
5 TH 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.	22PED50.1, 22PED50.2, 22PED50.3, 22PED50.4	Total 30 Hrs/ Semester 2 Hrs/week

	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. B. Rules and their interpretation and duties of officials.		
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. Hockey: A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing	22PED60.1, 22PED60.2, 22PED60.3, 22PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	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. 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.													
	<table><tr><th>CIE</th><th>Marks</th></tr><tr><td>Participation of student in all the modules</td><td>10</td></tr><tr><td>Quizzes – 2, each of 7.5 marks</td><td>15</td></tr><tr><td>Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students</td><td>25</td></tr><tr><td>Total</td><td>50</td></tr></table>	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		
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	22YOG30, 22YOG40, 22YOG50, 22YOG60	CIE Marks	50
L:T:P:S	0:0:0:0	SEE Marks	--
Hrs / Week	2	Total Marks	50 x 4 = 200
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		
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	PO11	PO12
22YOG50.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG50.4	-	-	-	-	-	3	-	-	-	-	-	1
Semester / Course Code	CONTENT								COs	HOURS		
3 rd 22YOG30	Introduction of Yoga: Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices. Suryanamaskara: 1. Suryanamaskar prayer and its meaning, Need, importance and b of Suryanamaskar. 2. Suryanamaskar 12 count, 2 rounds Different types of Asanas: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supine line: Utthitadvipadasana, Ardhalasana, Halasana								22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week		
4 TH 22YOG40	Suryanamaskara: Suryanamaskar 12 count, 4 rounds Brief introduction and importance of: Kapalabhati: Revision of Kapalabhati - 40 strokes/min 3 rounds Different types of Asanas: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakrasana Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya Bhedana								22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4	Total 32 Hrs/ Semester 2 Hrs/week		
5 TH 22YOG50	Kapalabhati: Revision of Kapalabhati - 60 strokes/min 3 rounds 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, Sarvanga Patanjali's Ashtanga Yoga: Pratyahara, Dharana								22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week		

	Pranayama: Ujjayi, Sheetal, Sheektari										
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)											
		<table><tr><th>CIE</th><th>Marks</th></tr><tr><td>Avg of Test 1 and Test 2</td><td>25</td></tr><tr><td>Demonstration of Yogasana</td><td>25</td></tr><tr><td>Total</td><td>50</td></tr></table>	CIE	Marks	Avg of Test 1 and Test 2	25	Demonstration of Yogasana	25	Total	50	
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 (Kavalayadhama, 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											

SIXTH SEMESTER

MACHINE LEARNING														
Course Code	22ISE61								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:														
22ISE61.1	Understand the problems for machine learning and select either supervised, unsupervised and reinforcement learning.													
22ISE61.2	Apply Classification concepts for solving machine learning problems.													
22ISE61.3	Implementation of association rule mining and correlation in data mining.													
22ISE61.4	Analyze Artificial Neural Networks (ANNs).													
22ISE61.5	Evaluating Convolutional Neural Network for Machine Learning Algorithms.													
22ISE61.6	Analyze the Reinforcement learning model using the Q Learning algorithm.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO2
22ISE61.1	3	3	3	2	2	2	-	-	1	-	1	1	3	2
22ISE61.2	3	3	3	3	2	2	-	-	1	-	1	1	3	2
22ISE61.3	3	3	3	3	2	2	-	-	1	-	1	1	3	2
22ISE61.4	3	3	3	3	2	2	-	-	1	-	1	1	3	2
22ISE61.5	3	3	3	3	2	2	-	-	1	-	1	1	3	2
22ISE61.6	3	3	3	3	2	2	-	-	1	-	1	1	3	2
MODULE-1	INTRODUCTION TO MACHINE LEARNING									22ISE61.1			8 Hours	
Introduction: Introduction to Machine Learning, Types of ML, Gradient (Steepest) Descent/Learning Rule, Introduction to Regression Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination algorithm.														
Self-study			Learn Reinforcement learning algorithms - Q Learning, Bellman Equations.											
Textbook			Textbook 3: Ch 1, Textbook 2 : Ch 2, Textbook 1: Ch 6.2											
MODULE-2	CLASSIFICATION OF DATA									22ISE61.2			8 Hours	
Decision Trees: Chi-Square Automatic Interaction Detectors (CHAID), Classification and Regression Tree (CART), C4.5. Support Vector Machine: Mathematical intuition of SVM, Kernel Functions – Linear, Polynomial, RBF.														
Self-study		Learn ID3 algorithm and implement them on any dataset for classification.												
Textbook		Textbook 2: Ch 3, Textbook 1: Ch 5.5, Textbook 3: Ch 13												
MODULE-3	ASSOCIATION & CORRELATION OF DATA									22ISE61.3			8 Hours	
Association Rule Mining: Use cases of association rule mining, Apriori, FP – Growth, Correlations: Basic Concepts and Methods, Pattern Mining in Multilevel, Multidimensional Space, Sequential Pattern Mining.														
Case Study		How and which association rule mining algorithms are implemented in Amazon Prime / Netflix.												
Textbook		Textbook 1: Ch 9												
MODULE-4	NEURAL NETWORKS									22ISE61.4			8 Hours	

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate Problems, Perceptron, Back Propagation algorithm.				
Federated Machine Learning: Types of Federated Machine Learning, models, Difference with traditional ML				
Application	Analyze the application of ANN in face detection biometric system.			
Textbook	Textbook 2: Ch 4			
MODULE-5	DATA IN ACTION	22ISE61.5, 22ISE61.6		8 Hours
Convolutional Neural Networks (CNN): Convolutional, Pooling and Soft-Max Layers, Training CNNs, and activation functions				
Reinforcement Learning: Introduction, The learning task, Q Learning.				
Case Study	How Machine learning techniques used in IOT, Data Science, and Artificial Intelligence.			
Textbook	Textbook 2: Ch 13			
CIE Assessment Pattern (50 Marks – Theory) –				
RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	5
L3	Apply	5	5	5
L4	Analyze	5	-	-
L5	Evaluate	5	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Exam Marks Distributi on (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	10		
L6	Create	-		
Suggested Learning Resources:				
Textbooks:				
1. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning using Python”, Wiley, First Edition, 2020.				
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, Indian Edition, 2017.				
3. Ethem Alpaydin, “Introduction to Machine Learning”, MITpress, Second Edition, 2010.				

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer Series in Statistics, Second Edition, 2017.
2. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems", A Press, First Edition, 2018.
3. Simon Haykin, "Neural Networks and Learning Machines", Pearson, Third Edition, 2016
4. Kevin P. Murphy, Francis Bach, "Machine Learning: A Probabilistic Perspective", Massachusetts Institute of Technology, First Edition, 2012.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_cs29
- https://onlinecourses.nptel.ac.in/noc22_cs08/
- <https://www.youtube.com/watch?v=I7NrVwm3apg>
- <https://www.analyticsvidhya.com/machine-learning/>
- <https://www.javatpoint.com/decision-tree-induction>
- <https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/ml-decision-tree/tutorial/>
- <https://www.youtube.com/watch?v=N6BghzuFLlg>
- <https://www.coursera.org/lecture/what-is-datascience/fundamentals-of-data-science-tPgFU>
- <https://www.youtube.com/watch?v=ua-CiDNNj30>

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

- Peer Learning
- Pictography
- Flip Class
- Group Discussion
- Case Study / Demonstration
- Gamified Learning

MACHINE LEARNING LABORATORY

Course Code	22ISL61	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	2	Total Marks	100
Credits	01	Exam Hours	03

Course outcomes:

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

22ISL61.1	Demonstrate Supervised, Unsupervised Learning algorithms.
22ISL61.2	Implement Concept Learning, Supervised Learning Algorithms.
22ISL61.3	Model the Association Rule Mining algorithms with real world problems.
22ISL61.4	Illustrate Artificial Neural Networks and Convolutional Neural Networks to solve machine learning problems

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
22ISL61.1	3	3	3	2	3	-	-	-	-	-	-	1	3	2
22ISL61.2	3	3	3	2	3	-	-	-	-	-	-	1	3	2

22ISL61.3	3	3	3	2	3	-	-	-	-	-	-	1	3	2
22ISL61.4	3	3	3	2	3	-	-	-	-	-	-	1	3	2
Pgm. No.	List of Programs											Hours	COs	
Prerequisite Programs														
	• Programming knowledge of Java / Python. • Able to identify appropriate dataset to the respective program. • Knowledge / detail understanding of the respective algorithm.											2	NA	
PART-A														
1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.											2	22ISL61.1	
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Document classifier using Naive Bayes.											2	22ISL61.1	
3	Develop a program to demonstrate the working of the decision tree based CHAID algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.											2	22ISL61.1	
4	Develop a program to demonstrate the working of the Regression tree-based CART algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.											2	22ISL61.1	
5	Develop a program to demonstrate the working of the gradient descent algorithm using an appropriate dataset and compute loss function.											2	22ISL61.2	
6	Develop a program to construct Support Vector Machine considering a Sample Dataset.											2	22ISL61.2	
PART-B														
7	Implement a program in python to illustrate the Bias Variance Trade-off in a machine learning model.											2	22ISL61.2	
8	Implement and demonstrate the Association Rule Mining using Apriori Algorithm.											2	22ISL61.2	
9	Implement and demonstrate the Association Rule Mining using FP-Growth Algorithm.											2	22ISL61.3	
10	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.											2	22ISL61.3	
11	Build a Convolutional Neural Networks and test the same using appropriate data sets.											2	22ISL61.4	
12	Implement Q learning algorithm.											2	22ISL61.4	
PART-C														
Beyond Syllabus Virtual Lab Content														
(To be done during Lab but not to be included for CIE or SEE)														
1. http://vlabs.iitkgp.ac.in/psac/newlabs2020/gnss/exp3/index.html														
2. https://cse22-iiith.vlabs.ac.in/exp/perceptron-learning/simulation.html														

CIE Assessment Pattern (50 Marks – Lab)			
RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	10	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)		
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:

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, Springer Series in Statistics, Second Edition, 2017.
2. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, “Practical Machine Learning with Python-A Problem-Solver’s Guide to Building Real-World Intelligent Systems”, APress, First Edition, 2018.
3. Simon Haykin, “Neural Networks and Learning Machines”, Pearson, Third Edition, 2016.

COMPUTER NETWORKS														
Course Code	22ISE62								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:														
22ISE62.1	Understand the Principle of Network Application													
22ISE62.2	Analyze the relation between Transport and Network Layer and study of data transfer.													
22ISE62.3	Identifying router function and need of IPV6.													
22ISE62.4	Analyze the routing Algorithms.													
22ISE62.5	Description of Wireless and Mobile Network standards and routing.													
22ISE62.6	Classification of Multimedia routing.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE62.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22ISE62.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22ISE62.3	3	3	3	2	3	-	-	-	-	-	-	2	3	3

22ISE62.4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22ISE62.5	3	3	3	2	3	-	-	-	-	-	-	2	3	3
22ISE62.6	3	3	3	3	2	-	-	-	-	-	-	2	3	3
MODULE-1	APPLICATION LAYER									22ISE62.1			8 Hours	
Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS, The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP.														
Text Book		Text Book 1: Chapter 2												
MODULE-2	TRANSPORT LAYER									22ISE62.2			8 Hours	
Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, RoundTrip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness.														
Text Book		Text Book 1: Chapter 3												
MODULE-3	NETWORK LAYER									22ISE62.3 22ISE62.4			8 Hours	
What's Inside a Router: Input Processing, Switching, Output Processing, Where Does Queuing Occur. Routing control plane, IPv4,IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast.														
Text Book		Text Book 1: Chapter 4												
MODULE-4	WIRELESS AND MOBILE NETWORKS									21ISE62.5			8 Hours	
Wireless links and Network Characteristics, WiFi 802.11Wireless LAN – Architecture, MAC Protocol, Frame, Mobility in same subnet, PAN – Bluetooth, Cellular Network Architecture, Extending Internet to cellular Subscribers. Mobile Management Principles- Addressing, Routing to Mobile Node, Mobile IP, Managing Mobility in cellular Networks. Introduction to 5G technologies and its significance.														
Text Book		Text Book 1: Chapter 7												
MODULE-5	MULTIMEDIA NETWORKING									22ISE62.6			8 Hours	
Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Voice-over-IP: Limitations of the Best-Effort IP Service ,Removing Jitter at the Receiver for Audio ,Recovering from Packet Loss Protocols for Real-Time Conversational Applications , RTP , SIP														
Text Book		Text Book 1: Chapter 9												

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	10	5
L4	Analyze	5	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. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017 .
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER

Web links and Video Lectures (e-Resources)

- https://gaia.cs.umass.edu/kurose_ross/ppt.php
- https://gaia.cs.umass.edu/kurose_ross/videos/1/

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

- Case Study
- Contents-related activities (Activity-based discussions)
- For active participation of students, instruct the students to solve and analyze various algorithms

COMPUTER NETWORKS LABORATORY														
Course Code	22ISL62							CIE Marks			50			
L:T:P:S	0:0:1:0							SEE Marks			50			
Hrs / Week	2							Total Marks			100			
Credits	1							Exam Hours			03			
Course outcomes:														
At the end of the course, the student will be able to:														
22ISL62.1	Understand about the Computer networks organization													
22ISL62.2	Analyze various routing Algorithm in a given network.													
22ISL62.3	Analyze communication between source and destination													
22ISL62.4	Use Network simulation tools for finding optimal routing.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
22ISL62.1	3	3	3	2	2	-	-	-	-	-	-	1	3	3
22ISL62.2	3	3	3	2	2	-	-	-	-	-	-	1	3	3
22ISL62.3	3	3	3	2	2	-	-	-	-	-	-	1	3	3
22ISL62.4	3	2	2	2	3	-	-	-	-	-	-	1	3	3
Pgm. No.	List of Programs											Hours	COs	
Prerequisite Programs														
	• Basic Programming language skills in Java, C, Python											2	NA	
PART-A														
1	Write a program for a distance vector algorithm to find a suitable path for transmission.											2	22ISL62.1 22ISL62.2	
2	Implementation of Stop and Wait Protocol.											2	22ISL62.1 22ISL62.2	
3	Write a program for congestion control using a leaky bucket algorithm.											2	22ISL62.1 22ISL62.2	
4	Write a program for error-detecting code using CRC.											2	22ISL62.3	
5	Implement the data link layer framing methods such as character, character stuffing, and bit stuffing.											2	22ISL62.3	
6	Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.											2	22ISL62.3	
PART-B														
7	Simulate a three-node point-to-point network with duplex links between them. Set the queue size and vary the bandwidth and find the number of packets dropped.											2	22ISL62.4	
8	Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate, and compare throughput											2	22ISL62.4	
9	Simulate an Ethernet LAN using n nodes set multiple traffic nodes and plot congestion windows for different source/destination											2	22ISL62.4	
10	Simulate a four-node point-to-point network with the links connected as follows: 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 determining the number of packets sent by TCP / UDP.											2	22ISL62.4	

11	Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion	2	22ISL62.4
12	Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.	2	22ISL62.4

PART-C

Beyond Syllabus Virtual Lab Content

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

<https://cse22-iiith.vlabs.ac.in/exp/forward-neural-networks/>

CIE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1. Computer Network, A Top Down Approach, Seventh Edition, Kurose Ross
2. Computer Networks: A Top-Down Approach, by Behrouz A. Forouzan and Firouz Mosharraf
3. <https://www.nsnam.org/docs/tutorial/html/>

CRYPTOGRAPHY AND INFORMATION SECURITY

Course Code	22ISE63	CIE Marks	50
L:T:P:S	2:1:0:0	SEE Marks	50
Hrs / Week	4	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes:

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

22ISE63.1	Understand the fundamentals of Cryptography, Network Security and its principles
22ISE63.2	Apply cryptographic algorithms for information security
22ISE63.3	Apply the various Authentication schemes to simulate different applications.
22ISE63.4	Apply various digital signature schemes for information security
22ISE63.5	Analyze various Security practices and System security standards
22ISE63.6	Design cryptographic algorithms into software projects.

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
22ISE63.1	3	3	3	3	3	3	-	-	-	-	-	1	3	3
22ISE63.2	3	3	3	3	3	3	-	-	-	-	-	1	3	3
22ISE63.3	3	3	3	3	3	3	-	-	-	-	-	1	3	3
22ISE63.4	3	3	3	3	3	3	-	-	-	-	-	1	3	3
22ISE63.5	3	3	3	3	3	3	-	-	-	-	-	1	3	3
22ISE63.6	3	3	3	3	3	3	-	-	-	-	-	1	3	3
MODULE-1	INTRODUCTION, CLASSICAL ENCRYPTION TECHNIQUES, INTRODUCTION TO NUMBER THEORY									22ISE63.1,			8 Hours	
INTRODUCTION: Security trends, The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network security. CLASSICAL ENCRYPTION TECHNIQUES: Symmetric Cipher Modes, Substitute Techniques, Transposition Techniques, Rotor Machines, Stenography. INTRODUCTION TO NUMBER THEORY: Prime Numbers, Fermat’s and Euler’s Theorem, Testing for Primality, The Chinese Remainder Theorem, Discrete logarithms,														
Text Book			Text Book 1:Ch 1											
MODULE-2	SYMMETRIC ENCRYPTION, ASYMMETRIC ENCRYPTION									22ISE63.2			8 Hours	
SYMMETRIC ENCRYPTION: Block cipher, Stream cipher, Data Encryption Standard (DES), Cipher Block Chaining (CBC), Multiple Encryption DES, Advanced Encryption Standard (AES). ASYMMETRIC ENCRYPTION: Principles of Asymmetric Encryption, Applications of asymmetric encryption methods, RSA, Elliptic Curve Cryptography. Other Public-Key Cryptosystems: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack.														
Text Book	Text Book 1: Ch 2													
MODULE-3	MESSAGE AUTHENTICATION, HASH FUNCTIONS AND ALGORITHMS, DIGITAL SIGNATURE, AUTHENTICATION APPLICATION									22ISE63.3 22ISE63.4			8 Hours	
MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs. HASH AND MAC ALGORITHM: Secure Hash Algorithm, HMAC, CMAC. DIGITAL SIGNATURE: Digital Signature, Authentication Protocol, Digital Signature Standard. AUTHENTICATION APPLICATION: Kerberos, X.509 Authentication Service														
Text Book	Text Book 1: TextBook1: Ch 3 Text Book 2: Ch 4													
MODULE-4	EMAIL SECURITY, IP SECURITY, WEB SECURITY									22ISE63.5			8 Hours	
EMAIL SECURITY: Pretty Good Privacy (PGP) and S/MIME. IP SECURITY: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. WEB SECURITY: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET)														
Text Book	Text Book 2: Ch 5, Ch 6, Ch 7													
MODULE-5	SYSTEM SECURITY, APPLYING CRYPTOGRAPHY ALGORITHMS									22ISE63.5 22ISE63.6			8 Hours	
SYSTEM SECURITY: Intruders, Malicious software, viruses, Firewalls. APPLYING CRYPTOGRAPHY ALGORITHMS: Smart cards, Mobile phone security, Electronic passports and ID cards, SDA/DDA/CDA Bank Cards,														
Text Book	Text Book 2: Ch 4.2													

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	10	5
L4	Analyze	5	5	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. William Stallings, "Cryptography and Network Security", 8th edition, Pearson Education, Reprint: 2022.
2. William Stallings "Network Security Essentials Applications and Standards", 2nd ed., Pearson Education, 2009.

Reference Books:

1. J. H. Silverman, A Friendly Introduction to Number Theory, 4th Ed. Boston: Pearson, 2012. (ISBN No.: 978-321-81619-1).
2. D. R. Stinson, Cryptography: Theory and Practice, 3rd Ed. Boca Raton, FL: Chapman & Hall/CRC, 2005. (ISBN No.: 978-1-58-488508-5)
3. C. Kaufman, R. Perlman, and M. Speciner, Network Security: Private Communication in a Public World, 2nd E United States: Prentice Hall PTR, 2002. (ISBN No.: 978-0-13-046019-6)

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106105031>
- https://onlinecourses.nptel.ac.in/noc21_cs16
- <https://www.digimat.in/nptel/courses/video/106105031>
- <https://www.youtube.com/watch?v=DEqjC0G5KwU>
- <https://www.youtube.com/watch?v=FqQ7TWvOaus>
- https://www.youtube.com/watch?v=PHsa_DdGx6w

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

- NPTEL course
- Contents related activities (Activity-based discussions)
- Problem Solving Exercises
- For active participation of students, instruct the students to solve and analyze various algorithms

BLOCKCHAIN

BLOCKCHAIN														
Course Code	22ISE641							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:														
22ISE641.1	Understand building blocks of Blockchain.													
22ISE641.2	Understand different Blockchain models.													
22ISE641.3	Apply the requirement of Distributed Ledger Technology and Smart Contract													
22ISE641.4	Design end-to-end decentralized applications													
22ISE641.5	Understand Blockchain ecosystem and its services in real world sceneries.													
22ISE641.6	Analyse the protocol and assess their computational requirements.													
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
22ISE641.1	3	3	3	2	1	-	-	-	-	-	-	1	3	3
22ISE641.2	3	3	3	2	1	-	-	-	-	-	-	1	3	3
22ISE641.3	3	3	3	2	1	-	-	-	-	-	-	1	3	3
22ISE641.4	3	3	3	2	1	-	-	-	-	-	-	1	3	3
22ISE641.5	3	3	3	2	1	-	-	-	-	-	-	1	3	3
22ISE641.6	3	3	3	2	1	-	-	-	-	-	-	1	3	3
MODULE-1	FOUNDATIONS OF BLOCKCHAIN							22ISE641.1 & 22ISE641.2				8 Hours		
Blockchain Architecture – Challenges – Applications – Blockchain Design Principles - The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - peer-to-peer network – Abstract Models - GARAY model - RLA Model - Proof of Work (PoW) - Proof of Stake (PoS) based Chains - Hybrid models.														
Self-study / Case Study /Applications	Write a case study on different Block Chain models.													
Text Book	Text Book 1: Ch 1.1 TO 1.5 , Ch 3.1 to 3.4 & Text Book 2: Ch1													
MODULE-2	DISTRIBUTED LEDGER TECHNOLOGY							22ISE641.3				8 Hours		
Origin of Ledgers – Types and Features of Distributed Ledger Technology (DLT) - Role of Consensus Mechanism - DLT Ecosystem - Distributed Ledger Implementations – Blockchain - Ethereum - Public and Private Ledgers – Registries – Ledgers - Practitioner Perspective: Keyless Technologies, Transparency as a Strategic Risk,														

Transparency as a Strategic Asset, Usage of Multiple IDs - Zero Knowledge Proofs - Implementation of Public and Private Blockchain.			
Self-study / Case Study /Applications	Explain about DLT Ecosystem.		
Text Book	Text Book 1: Ch 3.4 to 3.9 Ch 4.1 to 4.4		
MODULE-3	SMART CONTRACTS, DECENTRALIZED ORGANIZATION	22ISE641.4	8 Hours
Anatomy of a Smart Contracts - Life Cycle - Usage Patterns - DLT-based smart contracts - Use Cases: Healthcare Industry and Property Transfer. Decentralization versus Distribution - Centralized-distributed (Ce-Di) organizations - Decentralized-distributed (De-Di) organizations - Decentralized Autonomous Organizations: Aragon, DAOstack, DAOhaus and Colony.			
Self-study / Case Study /Applications	Illustrate the concept of DLT-based smart contracts.		
Text Book	Text Book 1: Ch 4.5 to 4.9		
MODULE-4	TYPES OF BLOCKCHAIN ECOSYSTEM	22ISE641.5	8 Hours
One-Leader Ecosystem - Joint Venture or Consortia Ecosystems - Regulatory Blockchain Ecosystems - Components in Blockchain Ecosystem: Leaders, Core Group, Active Participants, Users, Third-Party Service Providers - Governance for Blockchain Ecosystems.			
Self-study / Case Study /Applications	Examine Blockchain Ecosystem.		
Text Book	Textbook 1: Ch 5.1 to 5.4		
MODULE-5	BLOCKCHAIN PROTOCOLS	22ISE641.6	8 Hours
Ethereum tokens – Augur - Golem - Understanding Ethereum tokens - App Coins and Protocol Tokens - Blockchain Token Securities Law Framework - Token Economy - Token sale structure - Ethereum Subreddit.			
Self-study / Case Study /Applications	Interpret Block Chain Protocol Tokens.		
Text Book	Textbook 1: 6.1 to 6.6 Ch. 8.4 & 8.6		
CIE Assessment Pattern (50 Marks – Theory) –			
RBT Levels		Marks Distribution	
		Test (s) (25)	AAT1 (25)
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	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. Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st Edition, CA: Apress, Berkeley.
2. Diedrich, H., Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations, 2016, 1st Edition, Wildfire publishing, Sydney.
3. Wattenhofer, R. P, Distributed Ledger Technology: The Science of the Blockchain (Inverted Forest Publishing), 2017, 2nd Edition, Createspace Independent Pub, Scotts Valley, California, US.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_cs44/preview
- <https://www.youtube.com/watch?v=yubzlw0uiE4>

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

- For active participation of students, instruct the students to prepare for puzzles and presentations.
- Discussions on applications of Block Chain

SYSTEM MODELING AND SIMULATION

Course Code	22ISE642	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:

22ISE642.1	Understand simulation needs to test a variety of simulation models
22ISE642.2	Conceptualize real world situations related to systems development decisions
22ISE642.3	Discuss the simulation methods and select the suitable technique on the problems.
22ISE642.4	Analyse random number variates to develop simulation models
22ISE642.5	Create a model prediction based upon new input and validate the output data.
22ISE642.6	Evaluate the model for various case studies like inventory, traffic flow networks, etc.

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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE642.1	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22ISE642.2	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22ISE642.3	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22ISE642.4	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22ISE642.5	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22ISE642.6	3	2	2	2	2	-	-	-	-	-	-	1	3	2

MODULE-1	INTRODUCTION	22ISE642.1	8 Hours
Introduction: Simulation, Advantages and disadvantages, Areas of Application, System environment, components of a system, Model of a system, types of models, steps in a simulation study, Simulation of Queuing systems and Simulation of Inventory System.			
Text Book		Text Book 1: Ch 1, Ch 2	
MODULE-2	GENERAL PRINCIPLES, STATISTICAL MODELS IN SIMULATION	22ISE642.2 22ISE642.3	8 Hours
General Principles: Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Statistical Models in Simulation: Review of terminology and concepts, Useful statistical models, Discrete distributions. Continuous distributions, Poisson process.			
Self-study / Case Study / Applications	Reducing Emergency Department (ED) Wait Times using Discrete Event Simulation (DES).		
Text Book		Text Book 1: Ch 3, Ch 5	
MODULE-3	QUEUING THEORY, RANDOM NUMBERS	22ISE642.4	8 Hours
Queuing Theory: Arrival pattern distributions, servicing times, queuing disciplines, Steady-state behavior of M/G/1 queue. Random Numbers: Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test.			
Self-study / Case Study / Applications	Simulate a queuing system in a bank using MATLAB: Model customer arrivals, service times, and waiting times to optimize staffing levels and reduce wait times.		
Text Book		Text Book 1: Ch 6, Ch 7	
MODULE-4	INPUT MODELING	22ISE642.4 22ISE642.5	8 Hours
Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non- stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.			
Text Book		Text Book 1: Ch 9	
MODULE-5	OUTPUT ANALYSIS	22ISE642.5 22ISE642.6	8 Hours
Output Analysis – Types of Simulations with Respect to Output Analysis, Output analysis of terminating simulation, Output analysis of steady state simulations.			
Text Book		Text Book 1: Ch 11	
CIE Assessment Pattern(50 Marks – Theory)			
RBT Levels		Marks Distribution	
		Test (s)	AAT1
		25	25
L1	Remember	-	-
L2	Understand	10	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern(50 Marks – Theory)

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

Suggested Learning Resources:**Text Books:**

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: “ Discrete-EventSystem Simulation “, 5th Editio Pearson Education, 2010.

Reference Books:

1. Lawrence M. Leemis, Stephen K. Park: “ Discrete – Event Simulation: A First Course “, Pearson Education, 2006.
2. Averill M. Law: “ Simulation Modeling and Analysis “, 4th Edition, Tata McGraw- Hill, 2007.

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=-gYcZt5iKPA>
- <https://www.youtube.com/watch?v=yLae4Xz2W1Q>
- <https://www.youtube.com/watch?v=hye3ZBF45E>
- <https://www.youtube.com/watch?v=OsuBhg6TCzI>

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

- Contents related activities (Activity-based discussions)
- Problem Solving
- Case study

NATURAL LANGUAGE PROCESSING

Course Code	22ISE643								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:															
22ISE643.1	Understand the basic concepts of natural language														
22ISE643.2	Analyze the natural language text, speech and tag a text with basic language features														
22ISE643.3	Analyze the text and extract the relations from the text														
22ISE643.4	Apply text mining techniques to generate mining diagnostic reports														
22ISE643.5	Apply various methods to word matching, identifying different text types and evaluate the results of the methods														
22ISE643.6	Analyze the applications of NLP														
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	
22ISE643.1	3	3	3	3	2	-	-	-	-	-	-	2	3	3	
22ISE643.2	3	3	3	3	2	-	-	-	-	-	-	2	3	3	
22ISE643.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3	
22ISE643.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3	
22ISE643.5	3	3	3	3	2	-	-	-	-	-	-	2	3	3	

22ISE643.6	3	3	3	3	2	-	-	-	-	-	2	3	3
MODULE-1	OVERVIEW AND LANGUAGE MODELING								22ISE643.1		8 Hours		
Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modelling: Various Grammar- based Language Models Statistical Language Model.													
Text Book			Text Book: 1, Chapter: 1, 2										
MODULE-2	WORDS AND SPEECH								22ISE643.2		8 Hours		
Words - Regular Expressions and Automata - Words and Transducers -N-grams - Part-of-Speech – Tagging - Hidden Markov and Maximum Entropy Models. Speech – Phonetics - Speech Synthesis - Automatic Speech Recognition													
Text Book		Text Book: 1, Chapter: 3, 4											
MODULE-3	Extracting Relations from Text: From Word Sequences to Dependency Paths							22ISE643.3 22ISE643.4		8 Hours			
Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations.													
Text Book		Text Book: 2,Chapter: 3, 4, 5											
MODULE-4	Evaluating Self-Explanations in iSTART							22ISE643.5		8 Hours			
Evaluating Self-Explanations in iSTART Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results.													
Text Book		Text Book: 2,Chapter: 6, 7, 8, 9											
MODULE-5	INFORMATION RETRIEVAL AND LEXICAL RESOURCES							22ISE643.6		8 Hours			
Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net Stemmers-POS Tagger-Research Corpora.													
Text Book		Textbook 1: Ch. 9,12											
CIE Assessment Pattern (50 Marks – Theory)													
RBT Levels				Marks Distribution									
				Test (s)					AAT1				
				25					25				
L1	Remember			5					-				
L2	Understand			10					5				
L3	Apply			5					10				
L4	Analyze			5					10				
L5	Evaluate			-					-				
L6	Create			-					-				

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:**Text Books:**

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.

Web links and Video Lectures (e-Resources):

- <https://www.techtarget.com/searchenterpriseai/definition/language-modeling>
- <https://www.ibm.com/topics/natural-language-processing>
- <https://www.scaler.com/topics/nlp/relation-extraction-in-nlp/>
- <https://files.eric.ed.gov/fulltext/ED577164.pdf>
- <https://www.analyticsvidhya.com/blog/2021/09/latent-semantic-analysis-and-its-uses-in-natural-language-processing/>
- <https://nlp.stanford.edu/IR-book/html/htmledition/finite-automata-and-language-models-1.html>
- <https://www.geeksforgeeks.org/top-7-applications-of-natural-language-processing/>

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

DATA VISUALIZATION															
Course Code	22ISE644								CIE Marks			50			
L:T:P:S	3:0:0:0								SEE Marks			50			
Hrs / Week	03								Total Marks			100			
Credits	03								Exam Hours			3 Hours			
Course Outcomes: At the end of the Course, the Student will be able to:															
22ISE644.1	Understand the basic structure of python programming language.														
22ISE644.2	Apply MatPlotLib and Seaborn library to various datasets and infer the insights through visualizations.														
22ISE644.3	Apply visual analytics techniques using tableau for multidimensional datasets.														
22ISE644.4	Identify the application of interactive techniques, colors, animation and mapping and cartography in visualization of data.														
22ISE644.5	Create the interactive data related applications using Bokeh.														
22ISE644.6	Design the project presentations related to visualization tools.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
CO/PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
22ISE644.1	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
22ISE644.2	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
22ISE644.3	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
22ISE644.4	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
22ISE644.5	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
22ISE644.6	3	3	3	2	2	-	-	-	-	-	-	2	3	3	
MODULE-1	Introduction to Data Visualization									22ISE644.1			8 Hours		
Introduction to Data Visualization, Why do we use Data Visualization, Introduction to NumPy and pandas and Basic Plotting with MatPlotLib.															
Case Study / Applications			Investigate scatter plots and bubble chart using matplotlib lib.												
Text Book			Text Book 1: Ch 2, Ch3 Text Book 2: Ch1												
MODULE-2	Exploratory Data Analysis									22ISE644.2			8 Hours		
Exploratory Data Analysis: Waffle Charts, Word Clouds, Introduction to Folium and Map Styles, Maps with Markers, ChoroplethMaps, what are glyphs, Plotting with glyphs															
Case Study / Applications		Investigate waffle chart and world clouds with an example.													
Text Book		Text Book 2: Ch 5, Ch7, Ch 8													
MODULE-3	Introduction to Seaborn and Tableau									22ISE644.3			8 Hours		
Seaborn - Strip plot,pair grid plot, violinplots, cluster map, heat map, facet grid, KDEplot, join plot, Seaborn and Regression Plots, pair plots. Getting Started &Introduction to Data Visualization – Tableau, Exploring and Navigating Tableau,Making Data Connections.															
Case Study / Applications		Write a case study on grid plot an violin plot.													
Text Book		Text Book 2: Ch 3, Ch 5													
MODULE-4	Visual Analytics									22ISE644.4, 22ISE644.5			8 Hours		
Visual analytics : Introduction to Table Calculations, Calculated Fields, Quick Table Calculations, Custom Table Calculations, Filters, Parameters, Introduction to Mapping, Working with Geographic Data, Shapes, Colors and Sizes,Custom Mapping Techniques, Custom Geocoding, Dual Layer Mapping.															
Text Book		Text Book 2: Ch 9, Ch 10													

MODULE-5	Introduction to Bokeh	22ISE644.6	8 Hours
Interactive Data Visualization With Bokeh: Introduction to Bokeh, The Bokeh Workflow, Benefits of Bokeh, Challenges with Bokeh, Case Study.			
Text Book	Text Book 3: Ch 1, Ch 2		
CIE Assessment Pattern (50 Marks – Theory) –			
RBT Levels		Mark Distributions	
		Test (s)	AAT1
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	-	-
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. Kavitha Ranganathan, “Impactful Data Visualization”, 2023. 2. Scott Murray, “Interactive Data Visualization”, O’Reilly Publications, 2013 3. David Baldwin, “Mastering Tableau: Smart Business Intelligence techniques to get maximum insights from your data” , Packt Publications,2016. 4. Kevin Jolly, ”Hands-On Data Visualization with Bokeh: Interactive web plotting for Python using Bokeh” , Packt Publications,2015.			
Reference Books:			
1) EfraimTurban , Jay E. Aronson , Ting-Peng Liang, “Decision Support Systems & Intelligent Systems”, 9th edition, Prentice Hall, 2016. 2) Data, data everywhere, “Special report on managing information, Economist”, February 27th, 2016. 3) Liberatore and Luo, “The Analytics Movement, Interfaces, Articles in Advance”			
Web links and Video Lectures (e-Resources):			
https://nptel.ac.in/courses/110107092 https://nptel.ac.in/courses/106107220 https://onlinecourses-archive.nptel.ac.in/noc17_mg24/preview https://onlinecourses.nptel.ac.in/noc21_cs78/preview https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning			
Case Study on difference between basic plotting graphs using matplotlib and tableau.			

BIGDATA TECHNOLOGIES														
Course Code	22ISE645							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:														
22ISE645.1	Understand building blocks of Bigdata.													
22ISE645.2	Understand different Cloud concepts.													
22ISE645.3	Analyze the requirement of Hadoop and PySpark.													
22ISE645.4	Demonstrate the concept of Spark SQL.													
22ISE645.5	Understand Spark Streaming.													
22ISE645.6	Apply Deep Learning with big data on cloud.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ISE645.1	3	3	3	2	-	-	-	-	-	-	-	1	3	3
22ISE645.2	3	3	3	2	-	-	-	-	-	-	-	1	3	3
22ISE645.3	3	3	3	2	-	-	-	-	-	-	-	1	3	3
22ISE645.4	3	3	3	2	-	-	-	-	-	-	-	1	3	3
22ISE645.5	3	3	3	2	-	-	-	-	-	-	-	1	3	3
22ISE645.6	3	3	3	2	-	-	-	-	-	-	-	1	3	3
MODULE-1	INTRODUCTION TO BIGDATA							22ISE645.1 & 22ISE645.2			8 Hours			
Introduction: Big data concepts & GCP Platform Setup, Cloud concepts: Cloud-Native architecture, serverless computing, message queues, PaaS, SaaS, IaaS														
Self-study / Case Study /Applications	Write a case study on GCP Platform Setup.													
Text Book	Text Book 1: Ch 1.1 TO 1.5 , Ch 3.1 to 3.4 & Text Book 2: Ch1													
MODULE-2	DATA TYPES, INTRO TO BIG DATA ENGINEERING							22ISE645.3			8 Hours			
Types of Data: Data formats, sources & their semantics, processing & storage options on Cloud. Use of serverless to get started (e.g. Google Cloud Functions). Intro to Big Data Engineering: Hadoop and PySpark, ELT: ETL, processing patterns for large data, ETL vs ELT, role of a scheduler														
Self-study / Case Study /Applications	Explain about Hadoop and PySpark.													
Text Book	Text Book 1: Ch 3.4 to 3.9 Ch 4.1 to 4.4													
MODULE-3	SQL and NOSQL							22ISE645.4			8 Hours			
SQL & NoSQL: For most analysis tasks, SQL is sufficient. Tools like Spark SQL allow that familiarity to translate to big data solutions. Types of NoSQL, evolution, best-of-fit options.														

Self-study / Case Study /Applications	Illustrate the concept of Spark SQL.		
Text Book	Text Book 1: Ch 4.5 to 4.9		
MODULE-4	STREAMING	22ISE645.5	8 Hours
Streaming: Overview, Fundamental Concepts, Walkthrough of Google Pub/Sub & Google Data Flow as example technologies. Streaming: Kafka as another example of message queue technology & Spark Streaming.			
Self-study / Case Study /Applications	Examine DataProc with ML.		
Text Book	Textbook 1: Ch 5.1 to 5.4		
MODULE-5	DEEP LEARNING WITH BIG DATA	22ISE645.6	8 Hours
Big Data ML: DataProc with ML - including Spark ML (Batch processing) Deep Learning with big data on cloud.			
Self-study / Case Study /Applications	Interpret Deep Learning with big data on cloud.		
Text Book	Textbook 1: 6.1 to 6.6 Ch. 8.4 & 8.6		
CIE Assessment Pattern (50 Marks - Theory) -			
RBT Levels		Marks Distribution	
		Test (s) (25)	AAT1 (25)
L1	Remember	5	-
L2	Understand	5	-
L3	Apply	5	5
L4	Analyze	5	10
L5	Evaluate	5	10
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. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966			
2. Douglas Eadline, " <u>Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem</u> ", 1 st Edition, Pearson Education, 2016. ISBN13: 978-9332570351			

Reference Book
1) The Data Revolution: Big Data, Open Data, Data Infrastructures, And Their Consequences By Rob Kitchin
Web links and Video Lectures (e-Resources): https://onlinecourses.nptel.ac.in/noc20_cs92/preview https://www.youtube.com/watch?v=KCEPoPJ8sWw
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning ➤ For active participation of students, instruct the students to prepare for puzzles and presentations. ➤ Discussions on applications of Bigdata.

STORAGE AREA NETWORK															
Course Code	22ISE646							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:															
22ISE646.1	Distinguish between various physical and logical components of storage systems and their behavior, which is critical for successful design of storage infrastructure.														
22ISE646.2	Determine efficient storage provisioning technique and RAID implementation to meet applications capacity, availability and performance requirements.														
22ISE646.3	Identify different components of FC SAN and fabric login types														
22ISE646.4	Understand appropriate storage networking option such as IPSAN, NAS, and object - based and unified storage solutions to meet customer’s requirements.														
22ISE646.5	Apply IP SAN, NAS technologies to design data center based on the customer business requirements.														
22ISE646.6	Analyze the importance of backup, replication requirements and solutions, For business critical data.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
22ISE646.1	3	3	2	2	2	-	-	-	-	-	-	3	3	3	
22ISE646.2	3	3	2	2	2	-	-	-	-	-	-	3	3	3	
22ISE646.3	3	2	2	2	2	-	-	-	-	-	-	3	3	3	
22ISE646.4	3	3	2	2	2	-	-	-	-	-	-	3	3	3	
22ISE646.5	3	3	2	2	2	-	-	-	-	-	-	3	3	3	
22ISE646.6	3	3	2	2	2	-	-	-	-	-	-	3	3	3	
MODULE-1	INTRODUCTION TO INFORMATION STORAGE & DATA CENTER ENVIRONMENT										22ISE646.1		8 Hours		
Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Data Center Environment: Application, DBMS, Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application Requirements and Disk Performance, Disk Native Command Queuing, Introduction to Flash Drives.															

MODULE-2	DATA PROTECTION & INTELLIGENT STORAGE SYSTEMS	22ISE646.2	8 Hours																																
Data Protection: RAID, RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage System.																																			
MODULE-3	FIBRE CHANNEL STORAGE AREA NETWORKS	22ISE646.3, 22ISE646.4	8 Hours																																
Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, Virtualization technologies and processes.																																			
MODULE-4	IP SAN AND FCOE, NETWORK-ATTACHED STORAGE & OBJECT-BASED AND UNIFIED STORAGE	22ISE646.5	8 Hours																																
IP SAN and FCoE: iSCSI, FCIP, FCoE Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization. Object-Based and Unified Storage: Object-Based Storage Devices, Content-Addressed Storage, Unified Storage.																																			
MODULE-5	BACKUP AND ARCHIVE, LOCAL & REMOTE REPLICATION	22ISE646.6	8 Hours																																
Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Remote Replication: Modes of Remote Replication, Remote Replication Technologies, Network Infrastructure. Three-Site Replication, Data Migration Solutions.																																			
CIE Assessment Pattern (50 Marks – Theory)																																			
<table><tr><td colspan="2">Bloom’s Category</td><td>Tests</td><td>AAT1</td></tr><tr><td colspan="2">Marks (out of 50)</td><td>25</td><td>25</td></tr><tr><td>L1</td><td>Remember</td><td>5</td><td>-</td></tr><tr><td>L2</td><td>Understand</td><td>5</td><td>10</td></tr><tr><td>L3</td><td>Apply</td><td>10</td><td>10</td></tr><tr><td>L4</td><td>Analyze</td><td>5</td><td>5</td></tr><tr><td>L5</td><td>Evaluate</td><td>-</td><td>-</td></tr><tr><td>L6</td><td>Create</td><td>-</td><td>-</td></tr></table>				Bloom’s Category		Tests	AAT1	Marks (out of 50)		25	25	L1	Remember	5	-	L2	Understand	5	10	L3	Apply	10	10	L4	Analyze	5	5	L5	Evaluate	-	-	L6	Create	-	-
Bloom’s Category		Tests	AAT1																																
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L4	Analyze	5	5																																
L5	Evaluate	-	-																																
L6	Create	-	-																																
SEE Assessment Pattern (50 Marks – Theory)																																			
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Blooms Category		Tests																																	
L1	Remember	10																																	
L2	Understand	10																																	
L3	Apply	20																																	
L4	Analyze	10																																	
L5	Evaluate	-																																	
L6	Create	-																																	

Suggested Learning Resources:**Text Books:**

1. "Information Storage and Management", 2nd Edition, John Wiley- India 2012, G. Somasundaram, Alok Shrivastava (Editors)

Reference Books:

1. Storage Networks Explained, Ulf Troppens, Rainer Erkens and Wolfgang Muller, John Wiley India, 2nd Edition, 2016
2. Storage Networks: The Complete Reference, Robert Spalding, Tata McGraw Hill, 2nd Edition.
3. Storage Area Networks: Essentials A Complete Guide to Understanding and Implementing SANs, Richard Barker and Paul Massiglia, Wiley India.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106108058>
- https://www.youtube.com/watch?v=RBA7VsuVVOA&list=PLT19l_B1cBf87G-nEL8O_NTO27c6XVeX
- <https://www.youtube.com/watch?v=5-UO8RE1Ctk&pp=ygU9SU5UUk9EVUNUSU9OIFRPIEIORk9STUFUSU9OIFNUT1JBR0UgJiBEQVRBIENFTIRFUjBFTIZlUk9OTUVVOA%3D%3D>

PROJECT PHASE - 1

Course Code	22ISE65	CIE Marks	50
L:T:P:S	0:0:2:0	SEE Marks	50
Hrs / Week	0	Total Marks	100
Credits	2	Exam Hours	03

Course outcomes:

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

22ISE65.1	Identify an issue and derive problem related to society, environment, economics, energy and Technology
22ISE65.2	Formulate and analyze the problem and determine the scope of the solution chosen
22ISE65.3	Determine, break down, and estimate the parameters needed for the solution. Then, using testing tools, assess the solution by evaluating it in light of the standard data and the objective function, as well as by applying the proper performance metrics.
22ISE65.4	Create the report and take part in present / publishing the finding in a reputed conference / Publication

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
22ISE65.1	3	3	3	3	3	2	1	1	2	1	3	3	3	3
22ISE65.2	3	3	3	3	3	2	1	1	2	1	3	3	3	3
22ISE65.3	3	3	3	3	3	2	1	1	2	1	3	3	3	3
22ISE65.4	3	3	3	3	3	2	1	1	2	1	3	3	3	3

- Project Executed in an Industry or at an Institution
- The CIE for the project will be 50 marks.
- The panel members for the project review comprising of Head of department, expert members, respective guide, will assess the project progress and award the CIE marks based on their evaluations. Project activities should be reported by students to the guide on a regular basis.
- For project work, the minimum CIE mark requirement is 40% of the maximum mark.

- Students will be deemed to have failed the relevant course or courses if they are unable to receive at least 40% of the CIE marks in project work. They will also not be entitled to take the project examination administered by the university. They may, however, show up for exams administered by the university in other courses taken during the same semester, including any backlog courses.
- The student team must test the project work designed for the final project outcome.
- Students will appear for the SEE after earning the required minimum CIE grades in the course or courses when they are offered during the following semester.
- If a student has already received the minimum number of points needed for a project, they are not eligible to improve their CIE scores.
- In order to pass a project or viva-voce exam, a student must receive at least 40% of the total points required for the university exam.

CIE Assessment Pattern(100 Marks)

Bloom's Category		Tests (50 Marks)
L1	Remember	-
L2	Understand	-
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	20

SEE Assessment Pattern (100 Marks - Theory)

Bloom's Category		Tests (50 Marks)
L1	Remember	-
L2	Understand	-
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	20

PROBLEM SOLVING SKILLS														
Course Code	22SDK66								CIE Marks			50		
L:T:P:S	0:0:1:0								SEE Marks			-		
Hrs / Week	2								Total Marks			50		
Credits	1								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:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
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							22SDK66.1			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, 4 th 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

PROJECT MANAGEMENT USING GIT

Course Code	22ISE671	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	2	Total Marks	100
Credits	1	Exam Hours	03

Course outcomes:

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

22ISE671.1	Apply the basics commands related to GIT repository for creation and managing the branches.
22ISE671.2	Evaluate the effectiveness of Collaboration and Remote Repositories
22ISE671.3	Apply the commands related to GIT Tags, Releases and advanced GIT operations
22ISE671.4	Analyze and change the GIT history

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
22ISE671.1	3	3	3	3	2	-	-	-	-	-	1	3	3	3
22ISE671.2	3	3	3	2	2	-	-	-	-	-	1	3	3	3
22ISE671.3	3	3	3	3	2	-	-	-	-	-	1	3	3	3
22ISE671.4	3	3	3	3	2	-	-	-	-	-	1	3	3	3

Pgm. No.	List of Programs	Hours	Cos
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Prerequisite Programs

	Develop a project in the language of your choice.	2	NA
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PART-A

1	Introduction to distributed version control systems Setting Up and Basic Commands: Initialize a new GIT repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message. Option to recover the mistakes checkin.	2	22ISE671.1
2	Creating and Managing Branches: Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."	2	22ISE671.1
3	Creating and Managing Branches: Write the commands to stash your changes, switch branches, and then apply the stashed changes.	2	22ISE671.1
4	Collaboration and Remote Repositories: Clone a remote GIT repository to your local machine.	2	22ISE671.2
5	Collaboration and Remote Repositories: Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.	2	22ISE671.2
6	Collaboration and Remote Repositories: Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.	2	22ISE671.2

PART-B			
7	GIT Tags and Releases: Write the command to create a lightweight GIT tag named "v1.0" for a commit in your local repository.	2	22ISE671.3
8	Advanced GIT Operations: Write the command to cherry-pick a range of commits from "source-branch" to the current branch.	2	22ISE671.3
9	Analysing and Changing GIT History: Given a commit ID, how would you use GIT to view the details of that specific commit, including the author, date, and commit message.	2	22ISE671.4
10	Analysing and Changing GIT History: Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."	2	22ISE671.4
11	Analysing and Changing GIT History: Write the command to display the last five commits in the repository's history.	2	22ISE671.4
12	Analysing and Changing GIT History: Write the command to undo the changes introduced by the commit with the ID "abc123".	2	22ISE671.4
PART-C			
Beyond Syllabus Virtual Lab Content(To be done during Lab but not to be included for CIE or SEE) https://ps-iiith.vlabs.ac.in/exp/advanced-arithmetic/			
CIE Assessment Pattern (50 Marks – Lab)			
RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	05	10
L4	Analyze	05	10
L5	Evaluate	10	10
L6	Create	-	-
SEE Assessment Pattern (50 Marks – Lab)			
RBT Levels		Exam Marks Distribution (50)	
L1	Remember	-	
L2	Understand	-	
L3	Apply	10	
L4	Analyze	20	
L5	Evaluate	20	
L6	Create	-	
Suggested Learning Resources:			
Reference Books:			
1. Version Control with Git, Prem Kumar Ponuthorai, Jon Loeliger,3 rd Edition, October 2022, O'Reilly Media Inc.			
2. Pro Git book, Scott Chacon , Ben Straub, Apress, https://git-scm.com/book/en/v2			
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_share d /overview			
4. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_share d/overview			
5. Version Control with Git(1).pdf (yale.edu)			

ADVANCED PROGRAMMING USING C++														
Course Code	22ISE672								CIE Marks			50		
L:T:P:S	0:0:1:0								SEE Marks			50		
Hrs / Week	2								Total Marks			100		
Credits	01								Exam Hours			03		
Course outcomes:														
At the end of the course, the student will be able to:														
22ISE672.1	Understand class, objects, abstraction level, storage classes, operators in C++													
22ISE672.2	Design C++ code using the Control statements, jump statements, decision statements and functions in C++													
22ISE672.3	Apply OOP concepts like inheritance, polymorphism, virtual functions													
22ISE672.4	Design C++ code using file operations, exception handling, dynamic memory allocation in C++													
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
22ISE672.1	3	3	3	3	3	-	-	-	1	-	-	3	3	3
22ISE672.2	3	3	3	3	3	-	-	-	1	-	-	3	3	3
22ISE672.3	3	3	3	3	3	-	-	-	1	-	-	3	3	3
22ISE672.4	3	3	3	3	3	-	-	-	1	-	-	3	3	3
Pgm. No.	List of Programs											Hours	Cos	
Prerequisite Programs														
	Basics of C++											2		
PART-A														
1	Program to understand the data abstraction with different access specifiers.											2	22ISE672.1	
2	Program to demonstrate the scope and lifetime of the variables, include all the storage classes (auto, register, static, extern, mutable).											2	22ISE672.1	
3	Program to implement the bitwise operators on the variables. Include all bitwise operators in the program. (&, ,^,~,<<,>>)											2	22ISE672.1	
4	Program to demonstrate the working of jump statements (break, exit, continue, goto) in the nested loop.											2	22ISE672.2	
5	Program to implement nested switch and nested if statements.											2	22ISE672.2	
6	Program to understand various ways to call a function/method. Include all call types (call by value, call by reference and call by pointer).											2	22ISE672.2	
PART-B														
7	Program to understand the difference between multilevel inheritance and multiple inheritance.											2	22ISE672.3	
8	Program to demonstrate the working of function overloading and function overriding.											2	22ISE672.3	
9	To implement virtual functions and pure virtual functions in the class.											2	22ISE672.3	
10	Program to implement all the basic file operations (open, read, write, and close).											2	22ISE672.4	
11	Program to demonstrate exception handling (try, catch, throw).											2	22ISE672.4	
12	Program to understand dynamic memory allocation using 'new' and 'delete' operators.											2	22ISE672.4	

NOSQL															
Course Code	22ISE673									CIE Marks			50		
L:T:P:S	0:0:1:0									SEE Marks			50		
Hrs / Week	2									Total Marks			100		
Credits	01									Exam Hours			03		
Course outcomes: At the end of the course, the student will be able to:															
22ISE673.1	Understand, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph). Apply Document-orienteddatabases.														
22ISE673.2	Apply the detailed architecture; define objects, load data, query data and performance tune Columnar-databases.														
22ISE673.3	Understand the detailed architecture, define objects, load data, query data and performance tune Key-Value NoSQL databases.														
22ISE673.4	Analyse the detailed architecture, define objects, load data, query data and performance graph-based Databases.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	
22ISE673.1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	
22ISE673.2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	
22ISE673.3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	
22ISE673.4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	
Prog. No.	List of Programs											Hours	COs		
Prerequisite Programs															
	Database Management System.											2	NA		
PART-A															
1	Create a database and collection using MongoDB.											2	22ISE673.1		
2	Apply the respective functions to create one document and many documents at a time.											2	22ISE673.1		
3	Apply the respective functions to access one and many documents.											2	22ISE673.1		
4	Apply the respective functions to update one and many documents.											2	22ISE673.1		
5	Apply the respective functions to delete one and many documents.											2	22ISE673.1		
6	Create the keyspace and column family (table) in Cassandra using CQL.											2	22ISE673.2		
PART-B															
7	Apply the respective functions to insert one and many rows in Cassandra.											2	22ISE673.2		
8	Apply the respective functions to update one and many rows in Cassandra.											2	22ISE673.2		
9	Apply the respective functions to delete one and many rows in Cassandra.											2	22ISE673.2		
10	Create a key-value pair using redis database and apply the following commands; i) Type , ii) Del , iii) Keys *, iv) Exists , v) Expire											2	22ISE673.3		
11	Create a key-value pair using redis database and apply the following commands; i) MSET, ii) MGET, iii) INCRBY, iv) DECRBY, v) SETEX											2	22ISE673.3		

12	Draw the graph database for college database using 5 nodes with their associated relationships also write the query for all 5 nodes creation along with its properties and relationship creation.	2	22ISE673.4																														
PART-C Beyond Syllabus Virtual Lab Content https://cse02-iiith.vlabs.ac.in/exp/arrays/																																	
For SEE Examination: - One experiment from part A & One experiment from part B to be given - Examination will be conducted for 50 marks. - Marks Distribution : Procedure write-up – 20% Conduction – 60% Viva – Voce – 20% - Change of the experiment is allowed only once and procedure write-up marks will be considered as ‘0’																																	
CIE - Continuous Internal Evaluation (50 Marks) <table><tr><th colspan="2" rowspan="2">RBT Levels</th><th>Test (s)</th><th>Weekly Assessment</th></tr><tr><th>20</th><th>30</th></tr><tr><td>L1</td><td>Remember</td><td>-</td><td>-</td></tr><tr><td>L2</td><td>Understand</td><td>-</td><td>-</td></tr><tr><td>L3</td><td>Apply</td><td>05</td><td>10</td></tr><tr><td>L4</td><td>Analyze</td><td>05</td><td>10</td></tr><tr><td>L5</td><td>Evaluate</td><td>10</td><td>10</td></tr><tr><td>L6</td><td>Create</td><td>-</td><td>-</td></tr></table>				RBT Levels		Test (s)	Weekly Assessment	20	30	L1	Remember	-	-	L2	Understand	-	-	L3	Apply	05	10	L4	Analyze	05	10	L5	Evaluate	10	10	L6	Create	-	-
RBT Levels		Test (s)	Weekly Assessment																														
		20	30																														
L1	Remember	-	-																														
L2	Understand	-	-																														
L3	Apply	05	10																														
L4	Analyze	05	10																														
L5	Evaluate	10	10																														
L6	Create	-	-																														
SEE - Semester End Examination (50 Marks) <table><tr><th colspan="2">RBT Levels</th><th>Exam Marks Distribution (50)</th></tr><tr><td>L1</td><td>Remember</td><td>-</td></tr><tr><td>L2</td><td>Understand</td><td>-</td></tr><tr><td>L3</td><td>Apply</td><td>10</td></tr><tr><td>L4</td><td>Analyze</td><td>20</td></tr><tr><td>L5</td><td>Evaluate</td><td>20</td></tr><tr><td>L6</td><td>Create</td><td>-</td></tr></table>				RBT Levels		Exam Marks Distribution (50)	L1	Remember	-	L2	Understand	-	L3	Apply	10	L4	Analyze	20	L5	Evaluate	20	L6	Create	-									
RBT Levels		Exam Marks Distribution (50)																															
L1	Remember	-																															
L2	Understand	-																															
L3	Apply	10																															
L4	Analyze	20																															
L5	Evaluate	20																															
L6	Create	-																															

ANGULAR JS			
Course Code	22ISE674	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	2	Total Marks	100
Credits	1	Exam Hours	03
Course outcomes: At the end of the course, the student will be able to:			
22ISE674.1	Apply Angular JS features for developing dynamic web applications.		
22ISE674.2	Develop three tier architecture-based applications with AngularJS supported design pattern.		
22ISE674.3	Make use of form validations and controls for interactive applications		
22ISE674.4	Apply the concepts of Expressions, data bindings and filters in developing Angular JS programs		
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
22ISE674.1	3	3	3	3	2	-	-	-	-	-	-	1	3	3
22ISE674.2	3	3	3	2	2	-	-	-	-	-	-	1	3	3
22ISE674.3	3	3	3	3	2	-	-	-	-	-	-	1	3	3
22ISE674.4	3	3	3	3	2	-	-	-	-	-	-	1	3	3
Pgm. No.	List of Programs											Hours	COs	
Prerequisite Programs														
	- Create HTML based web pages. Include CSS style sheets and designing - Database Management system CRUD operations execution on DB prompt.											2	NA	
PART-A														
1	Develop Angular JS program that allows user to input their first name and last name and display their full name. Note: The default values for first name and last name may be included in the program.											2	22ISE674.1	
2	Develop an Angular JS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers. Note: The default values of items may be included in the program.											2	22ISE674.1	
3	Develop a simple Angular JS calculator application that can perform basic mathematical operations (addition, subtraction, multiplication, division) based on user input.											2	22ISE674.1	
4	Write an Angular JS application that can calculate factorial and compute square based on given user input.											2	22ISE674.1	
5	Develop AngularJS application that displays a detail of students and their CGPA. Allow users to read the number of students and display the count. Note: Student details may be included in the program.											2	22ISE674.2	
6	Develop an AngularJS program to create a simple to-do list application. Allow users to add, edit, and delete tasks. Note: The default values for tasks may be included in the program.											2	22ISE674.2	
PART B														
7	Write an AngularJS program to create a simple CRUD application (Create, Read, Update, and Delete) for managing users.											2	22ISE674.2	
8	Develop AngularJS program to create a login form, with validation for the username and password fields.											2	22ISE674.2	
9	Create an AngularJS application that displays a list of employees and their salaries. Allow users to search for employees by name and salary. Note: Employee details may be included in the program.											2	22ISE674.3	
10	Create AngularJS application that allows users to maintain a collection of items. The application should display the current total number of items, and this count should automatically update as items are added or removed. Users should be able to add items to the collection and remove them as needed. Note: The default values for items may be included in the program.											2	22ISE674.3	
11	Create AngularJS application to convert student details to Uppercase using angular filters. Note: The default details of students may be included in the program.											2	22ISE674.4	
12	Create an AngularJS application that displays the date by using date											2	22ISE674.4	

		filter parameters			
PART-C					
Beyond Syllabus Virtual Lab Content (To be done during Lab but not to be included for CIE or SEE)					
https://cpe-iitg.vlabs.ac.in/exp/consistency-and-inconsistency/					
CIE Assessment Pattern (50 Marks – Lab)					
RBT Levels		Test (s)	Weekly Assessment		
		20	30		
L1	Remember	-	-		
L2	Understand	-	-		
L3	Apply	05	10		
L4	Analyze	05	10		
L5	Evaluate	10	10		
L6	Create	-	-		
SEE Assessment Pattern (50 Marks – Lab)					
RBT Levels		Exam Marks Distribution (50)			
L1	Remember	-			
L2	Understand	-			
L3	Apply	10			
L4	Analyze	20			
L5	Evaluate	20			
L6	Create	-			
Suggested Learning Resources:					
Reference Books:					
1. Shyam Seshadri, Brad Green, “AngularJS: Up and Running: Enhanced Productivity with Structured Web Apps”, Apress, O'Reilly Media, Inc.					
2. Agus Kurniawan, “AngularJS Programming by Example”, First Edition, PE Press, 2014					
Reference weblinks and Video Lectures (e-Resources):					
• Introduction to Angular JS https://www.youtube.com/watch?v=HEbphzK-0xE					
• Angular JS Modules https://www.youtube.com/watch?v=gWm0KmgnQkU					
• https://www.youtube.com/watch?v=zKkUN-mJtPQ					

NATIONAL SERVICE SCHEME (NSS)			
Course Code	22NSS30, 22NSS40, 22NSS50, 22NSS60	CIE Marks (each Semester)	50
L:T:P:S	0:0:0:0	SEE Marks	--
Hrs / Week	2	Total Marks	50 x 4 = 200
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:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
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
3 RD 22NSS30	12. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 13. Waste management–Public, Private and Govt organization, 5R's. 14. Setting of the information imparting club for women leading to contribution in social and economic issues.									22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4		30 HRS
4 TH 22NSS40	15. Water conservation techniques – Role of different stakeholders– Implementation. 16. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 17. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.									22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4		30 HRS
5 TH 22NSS50	18. Developing Sustainable Water management system for rural areas and implementation approaches. 19. 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 development programs etc. 20. Spreading public awareness under rural outreach programs. (minimum 5 programs).									22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4		30 HRS
6 TH 22NSS60	21. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 22. 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:

- Students should have a service-oriented mindset and social concern.
- Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
- 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, Indian Agriculture (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 Govt organization, 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 contribution in 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 to achieve 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/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 rural outreach programs. (minimum 5 programs)	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
10.	Organize National integration and social harmony 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
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PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)												
Course Code	22PED30, 22PED40, 22PED50, 22PED60						CIE Marks (each semester)			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 4= 200		
Credits	00						Exam Hours			02		
Course outcomes: At the end of the course, the student will be able to:												
22PED60.1	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:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22PED60.1	-	-	-	-	-	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	
3 RD 22PED30	Module 1: Orientation F. Lifestyle, G. Fitness H. Food & Nutrition I. Health & Wellness J. Pre-Fitness test.								22PED30.1, 22PED30.2		5 HRS	
	Module 2: General Fitness & Components of Fitness G. Warming up (Free Hand exercises) H. Strength – Push-up / Pull-ups I. Speed – 30 Mtr Dash J. Agility – Shuttle Run K. Flexibility – Sit and Reach L. Cardiovascular Endurance – Harvard step Test								22PED30.2, 22PED30.3		15 HRS	
	Module 3: Recreational Activities E. Postural deformities.								22PED30.3, 22PED30.4		10 HRS	

	F. Stress management. G. Aerobics. H. Traditional Games.		
4 TH 22PED40	Module 1: Ethics and Moral Values C. Ethics in Sports D. Moral Values in Sports and Games	22PED40.1, 22PED40.2	5 HRS
	Module 2: Specific Games (Anyone to be selected by the student) G. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. H. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. I. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. J. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. K. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. L. Athletics (Track / Field Events) – Any event as per availability of Ground.	22PED40.3	20 HRS
	Module 3: Role of Organization and administration	22PED40.4	5 HRS
5 TH 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: 4. 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. 5. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 6. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball: B. Fundamental Skills 7. Catching, Throwing and Ball control, 8. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 9. Dribbling: High and low. 10. Attack and counter attack, simple counter attack, counter attack from two wings and center. 11. Blocking, Goal Keeping and Defensive skills. 12. Game practice with application of Rules and Regulations. C. Rules and their interpretations and duties of officials	22PED50.1, 22PED50.2, 22PED50.3, 22PED50.4	Total 30 Hrs/ Semester 2 Hrs/week

	Ball badminton: B. Fundamental Skills 5. Basic Knowledge: Various parts of the Racket and Grip. 6. Service: Short service, Long service, Long-high service. 7. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.		
6TH 22PED60	Athletics: 4. 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. 5. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 6. 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. 10. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 11. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 12. Heading: In standing, running and jumping condition. 13. Throw-in: Standing throw-in and Running throw-in. 14. Feinting: With the lower limb and upper part of the body. 15. Tackling: Simple Tackling, Slide Tackling. 16. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 17. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. Hockey: A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 9. Penalty stroke practice.	22PED60.1, 22PED60.2, 22PED60.3, 22PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	10. Penalty corner practice. 11. Tackling: Simple Tackling, Slide Tackling. 12. Goal Keeping, Ball clearance- kicking, and deflecting. 13. Game practice with application of Rules and Regulations. 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.													
	<table><tr><th>CIE</th><th>Marks</th></tr><tr><td>Participation of student in all the modules</td><td>10</td></tr><tr><td>Quizzes – 2, each of 7.5 marks</td><td>15</td></tr><tr><td>Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students</td><td>25</td></tr><tr><td>Total</td><td>50</td></tr></table>	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		
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. 15. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York. 16. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi. 17. SallyKus, Coaching Volleyball Successfully, Human Kinetics.													

YOGA												
Course Code	22YOG30, 22YOG40, 22YOG50, 22YOG60						CIE Marks			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 4 = 200		
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											
22YOG60.4	Use the teachings of Patanjali in daily life.											
Mapping of Course Outcomes to Program Outcomes:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22YOG60.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.2	-	-	-	-	-	3	-	-	-	-	-	1

22YOG60.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.4	-	-	-	-	-	3	-	-	-	-	-	1
Semester / Course Code	CONTENT										COs	HOURS
3 rd 22YOG30	Introduction of Yoga: Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices. Suryanamaskara: 3. Suryanamaskar prayer and its meaning, Need, importance and b of Suryanamaskar. 4. Suryanamaskar 12 count, 2 rounds Different types of Asanas: 5. Sitting: Padmasana, Vajrasana, Sukhasana 6. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 7. Prone line: Bhujangasana, Shalabhasana 8. Supine line: Utthitadvipadasana, Ardhalasana, Halasana										22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week
4 th 22YOG40	Suryanamaskara: Suryanamaskar 12 count, 4 rounds Brief introduction and importance of: Kapalabhati: Revision of Kapalabhati - 40 strokes/min 3 rounds Different types of Asanas: 5. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 6. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 7. Prone line: Dhanurasana 8. Supine line: Karna Peedasana, Sarvangasana, Chakraasana Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya Bhedana										22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4	Total 32 Hrs/ Semester 2 Hrs/week
5 th 22YOG50	Kapalabhati: Revision of Kapalabhati - 60 strokes/min 3 rounds 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, Sarvanga Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetal, Shektari										22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week

6 TH 22YOG60	Kapalabhati: Revision of Kapalabhati – 80 strokes/min3rounds	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week								
	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: Jananeti and sutraneti, Sheetkarma Kapalabhati											
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)											
<table><tr><td>CIE</td><td>Marks</td></tr><tr><td>Avg of Test 1 and Test 2</td><td>25</td></tr><tr><td>Demonstration of Yogasana</td><td>25</td></tr><tr><td>Total</td><td>50</td></tr></table>		CIE	Marks	Avg of Test 1 and Test 2	25	Demonstration of Yogasana	25	Total	50		
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											

APPENDIX A

Assessment Pattern

1. Assignment
2. Group Discussions
3. Case Studies
4. Practical Orientation on Design Thinking , Creativity & Innovation
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 Visits
10. Industrial/Social/Rural Projects
11. Participation in external Seminars/Workshop
12. Online/Offline Quizzes

APPENDIX B

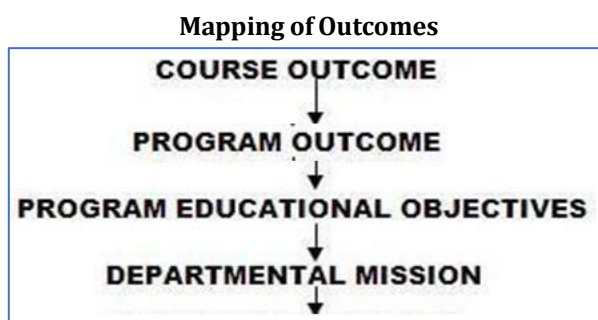
Outcome Based Education

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



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 modeling 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.

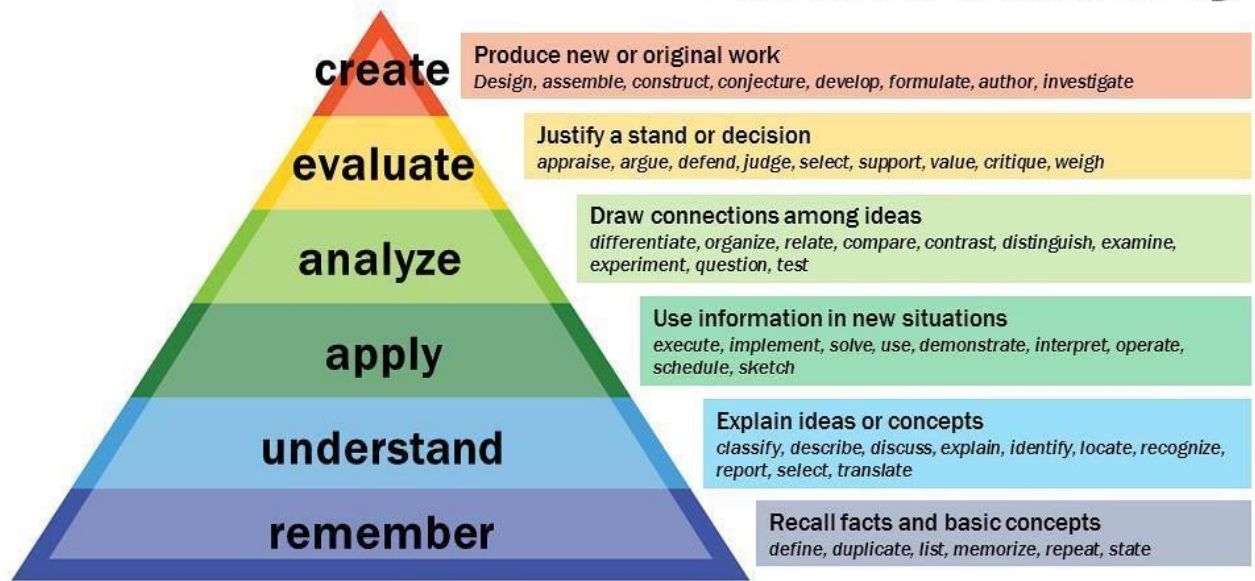
Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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.

Bloom's Taxonomy



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