NEW HORIZON
COLLEGE OF ENGINEERING

Department of Information Science and Engineering

Academic Year 2024-25

5th and 6th Semester

Scheme & Syllabus

BATCH: 2022-26

CREDITS:160

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:** The basic knowledge of Mathematics, Science and Engineering.
2.	Problem analysis	**PO2:** An Ability to analyze, formulate and solve engineering problems.

3.	Design and Development of Solutions	**PO3:** An Ability to design system, component or product and develop interfaces among subsystems of computing.
4.	Investigation of Problem	**PO4:** An Ability to identify, formulate and analyze complex engineering problem and research literature through core subjects of Computer Science.
5.	Modern Tool usage	**PO5:** An Ability to use modern engineering tools and equipments for computing practice.
6.	Engineer and society	**PO6:** An Ability to assess societal, health, cultural, safety and legal issues in context of professional practice in Computer Science & Engineering.
7.	Environment and sustainability	**PO7:** The broad education to understand the impact of engineering solution in a global, economic, environmental and societal context.
8.	Ethics	**PO8:** An understanding of professional and ethical responsibility.
9.	Individual & team work	**PO9:** An Ability to work both as individual and team player in achieving a common goal.
10.	Communication	**PO10:** To communicate effectively both in written and oral formats with wide range of audiences.
11.	Lifelong learning	**PO11:** Knowledge of contemporary issues, Management and Finance.
12.	Project management and Finance	**PO12:** An Ability to recognize the need and thereby to engage in independent and life-long learning for continued professional and career advancement.

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 2022- 2026 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	Minor 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

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Information Science and Engineering

Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

VI Semester													
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	PCC	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	23NHOP6XX	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, C**IE**: 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
22SISE645	Bigdata Technologies	22ISE646	Storage Area Network

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

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:	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session
1-hour Lecture (L) per week=1Credit	
2-hoursTutorial(T) per week=1Credit	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 of Teaching-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	PSO1	PSO2
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 selicitation 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)	Qualitative Assessment (s)	MCQ's
		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	AnalAply 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:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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: Ch 1, Ch 2, Ch 3, Ch 4, Ch 5

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: Ch 4, Ch 5, Ch 6

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:Ch 8, Ch 9 ,Text Book 2: Ch 5

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

NP Complete and NP-Hard problems: Basic concepts-non-deterministic algorithms-P, NP, NP-Complete, and NP-Hard classes			
Text Book	Text Book 1: Ch 11, Ch 12		
MODULE-5	**STRING MATCHING ALGORITHM, PARALLEL ALGORITHMS: ONLINE ALGORITHMS**	**22ISE52.5 22ISE52.6**	**8 Hours**
String matching algorithm: KMP String matching algorithm- Boyer Moore String matching algorithm **Parallel algorithms:** PRAM models, Prefix computation, Sorting on a mesh. **Online Algorithms:** K-server problem, List update problem			
Text Book	Text Book 2: Ch 13, Ch 14 Reference Book: Ch 32		

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	-	-
L3	Apply	10	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) Anany Levitin , "Introduction to the Design and Analysis of Algorithms,3rd Edition, Pearson, 2012
2) Ellis Horowitz, Satraj Sahni and Rajasekaran, "Computer Algorithms/C++", 2nd Edition, Universities Press, 2014

Reference Books:

1) Cormen T.H., Leiserson C.E., Rivest R.L., Stein C, "Introduction to Algorithms", 4th Edition, The MIT Press, 2022

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- https://archive.nptel.ac.in/courses/106/106/106106131/
- https://cs.uwaterloo.ca/~r5olivei/courses/2020-fall-cs466/lecture20-k-server-post.pdf
- https://www.cs.huji.ac.il/~ornak/publications/atva11a.pdf
- http://algo2.iti.kit.edu/vanstee/courses/kserver.pdf

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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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**
	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
	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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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)	Qualitative Assessment (s)	MCQ's
		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://www.mastersindatascience.org/
- 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:														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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)	**NPTEL**
		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,"DigitalCommunications",TMH,5thEd.,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	PSO1	PSO2
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)	**NPTEL**
		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, 5STARCooks Publisher, 2020 Edition
2. Definitive guide to Cloud Computing, Shargunam .S, R. Mallika Pandeeswari, 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)	NPTEL (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 andpresentations.
- 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)	NPTEL
		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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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)	NPTEL
		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, History and 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. **AWS Developer 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)	NPTEL
		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 Gene Kim (Author), George Spafford (Author), Kevin Behr ,Publisher : IT Process Institute, Inc.; Revised First Edition (15 June 2015)
3. The Goal: A Process of Ongoing Improvement Kindle Editionby Eliyahu M. Goldratt (Author), Jeff Cox ,North River Press; 3rd edition (June 1, 2012)

Web links and Video Lectures (e-Resources):

1. http://dev2ops.org/
2. https://puppet.com/resources
3. https://devopsdays.org/
4. https://dzone.com/devops-tutorials-tools-news

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

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

- Video Sessions
- Organizing Group Wise Discussions
- Seminars

CRITICAL AND CREATIVE THINKING SKILLS			
Course Code	**22SDK56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**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:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO100**	**PO11**	**PO12**
22ESK57.1	-	-	-	-	-	3	3	-	-	-		-
22ESK57.2	-	-	-	-	-	3	3	-	-	-	-	3
22ESK57.3	-	-	-	-	-	3	3	3	-	3	-	3

22ESK57.4	-	-	-	-	1	3	3	3	-	3	-	3

MODULE 1	**INTRODUCTION TO ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY**	**22ESK57.1**	**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)	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	-	-
L2	**Understand**	10	5	5
L3	**Apply**	10	5	5
L4	**Analyze**		5	-
L5	**Evaluate**		-	-
L6	**Create**		**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

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

MINI PROJECT - II

Course Code	**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:

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

Semester/ Course Code	CONTENT	COs	HOURS
3RD 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
4TH 22NSS40	**4.** Water conservation techniques – Role of different stakeholders– Implementation. **5.** Preparing an actionable business proposal for enhancing the village income and approach forimplementation. **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
5TH 22NSS50	**7.** Developing Sustainable Water management system for rural areas and implementationapproaches. **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 developmentprograms etc. **9.** Spreading public awareness under rural outreach programs. (minimum 5 programs).	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS
6TH 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 contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

6.	Helping local schools 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/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and 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 andhelping 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:

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

Semester	**CONTENT**	**COs**	**HOURS**
3RD 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
4TH 22PED40	**Module 1: Ethics and Moral Values** A. Ethics in Sports B. Moral Values in Sports and Games	22PED40.1, 22PED40.2	5 HRS
	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
5TH 22PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center.	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.

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**
3rd 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,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week
4TH 22YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **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, 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
5TH 22YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvanga **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week

	Pranayama: Ujjayi, Sheetali, 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)

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

Suggested Learning Resources:

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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)	**Qualitative Assessment (s)**	**MCQ's**
		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 Distribution (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", MIT press, 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=N6BghzuFLIg
- 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	PSO1	PSO2
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, SecondEdition, 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	**21ISE62**	**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:

21ISE62.1	Understand the Principle of Network Application
21ISE62.2	Analyze the relation between Transport and Network Layer and study of data transfer.
21ISE62.3	Identifying router function and need of IPV6.
21ISE62.4	Analyze the routing Algorithms.
21ISE62.5	Description of Wireless and Mobile Network standards and routing.
21ISE62.6	Classification of Multimedia routing.

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
21ISE62.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3
21ISE62.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3
21ISE62.3	3	3	3	2	3	-	-	-	-	-	-	2	3	3

21ISE62.4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
21ISE62.5	3	3	3	2	3	-	-	-	-	-	-	2	3	3
21ISE62.6	3	3	3	3	2	-	-	-	-	-	-	2	3	3

MODULE-1	**APPLICATION LAYER**	**21ISE62.1**	**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**	**21ISE62.2**	**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**	**21ISE62.3** **21ISE62.4**	**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**	**21ISE62.6**	**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)	Qualitative Assessment (s)	MCQ's
		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 Brusce 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 LAB			
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	PSO1	PSO2
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)	Qualitative Assessment (s)	MCQ's
		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,"CryptographyandNetworksecurity",8th edition .,Pearson Education, Reprint: 2022.

2. William Stallings "Network Security Essentials Applications and Standards", 2nded., 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. (ISB 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

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)	**NPTEL (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=yubzJw0uiE4

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

- For active participation of students, instruct the students to prepare for puzzles andpresentations.
- 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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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)	NPTEL
		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=hye3ZBFe45E
- 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)	**NPTEL**
		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-extration-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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 matplot 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 – Tableu, 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)	NPTEL
		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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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)	**NPTEL (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, " Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st 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 andpresentations.
- 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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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)

Bloom's Category		Tests	NPTEL
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**	-	-

SEE Assessment Pattern (50 Marks – Theory)

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, Rebert 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_B1cjBf87G-nEL8O_NTO27c6XVeX
- https://www.youtube.com/watch?v=5-UO8RE1Ctk&pp=ygU9SU5UUk9EVUNUSU9OIFRPIElORk9STUFUSU9OIFNUT1JBR0UgJiBEQVRBIENFTlRFUiBFTlZJUk9OTUVOVA%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:

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

22SDK66.4	3	3	3	2	2	-	-	-	-	-	-	2	2	2

MODULE-1	**PROBLEM SOLVING ON DATA STRUCTURES AND C**	**22SDK66.I**	**6 Hours**

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

MODULE-2	**PROBLEM SOLVING ON OBJECT ORIENTED PROGRAMMING USING CPP**	**22SDK66.2**	**6 Hours**

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

MODULE-3	**PROBLEM SOLVING ON JAVA AND XML**	**22SDK66.2**	**6 Hours**

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

MODULE-4	**PROBLEM SOLVING USING C # AND PYTHON**	**22SDK66.3**	**6 Hours**

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

MODULE-5	**SCENARIO BASED PROBLEMS ON DBMS**	**22SDK66.4**	**6 Hours**

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

CIE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

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

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	PSO1	PSO2
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
	Prerequisite Programs		
	Develop a project in the language of your choice.	2	NA
	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-arithmatic/

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,3rd Edition, October 2022, O'Reilly Media Inc.
2. Pro Git book, Scott Chacon , Ben Straub, Apress, https://gitscm.com/book/en/v2
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_shared /overview
4. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_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

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/searching-and-sorting/objective.html
https://ds1-iiith.vlabs.ac.in/exp/linked-list/index.html
https://ds2-iiith.vlabs.ac.in/exp/min-spanning-trees/index.html

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt. Ltd, Fourth Edition 2010.

Weblinks and Video Lectures (e-Resources):

- Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
- Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. https://www.edx.org/course/introduction-to-c-3

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	PSO1	PSO2
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)

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)

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, 0'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:

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

Semester/ Course Code	CONTENT	COs	HOURS
3RD 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
4TH 22NSS40	**15.** Water conservation techniques – Role of different stakeholders– Implementation. **16.** Preparing an actionable business proposal for enhancing the village income and approach forimplementation. **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
5TH 22NSS50	**18.** Developing Sustainable Water management system for rural areas and implementationapproaches. **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 developmentprograms etc. **20.** Spreading public awareness under rural outreach programs. (minimum 5 programs).	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS
6TH 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, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and 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 contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

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

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

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)			
Course Code	**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:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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**
3RD 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.		
4TH 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
5TH 22PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 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.

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:

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

22YOG60.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG60.4	-	-	-	-	-	3	-	-	-	-	-	1

Semester / Course Code	**CONTENT**	**COs**	**HOURS**
3rd 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,2rounds **Different types of Asanas**: 5. Sitting: Padmasana, Vajrasana, Sukhasana 6. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 7. Prone line: Bhujangasana, Shalabhasana 8. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week
4TH 22YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **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
5TH 22YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvanga **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week

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

CIE Assessment Pattern (50 Marks – Practical)

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

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

Suggested Learning Resources:

Reference Books:

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

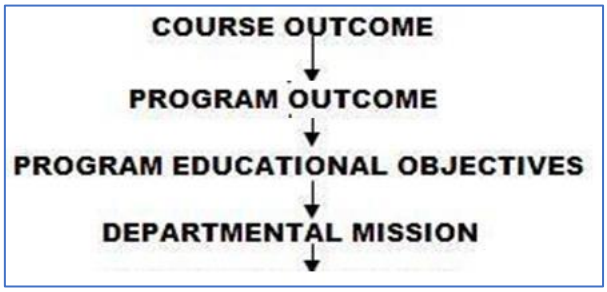
Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities,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

Mapping of Outcomes



APPENDIX C

The Graduate Attributes of NBA

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

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

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

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

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and 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.

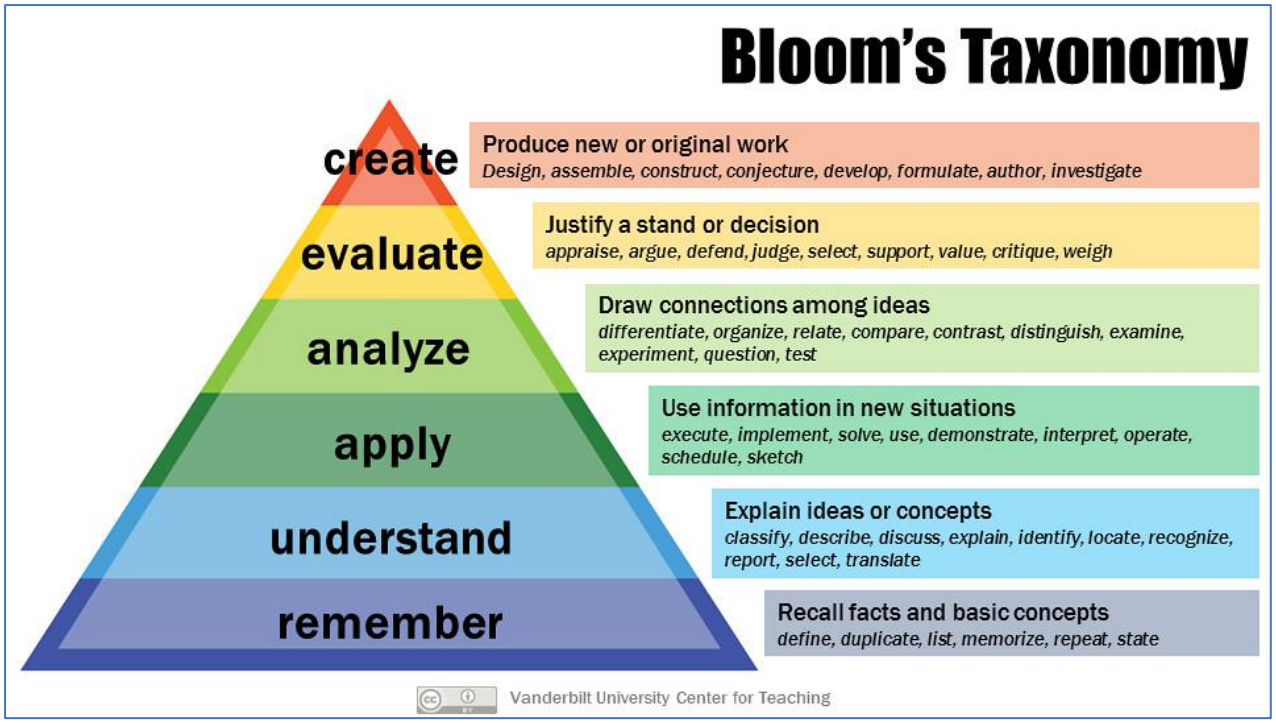
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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
create
evaluate
analyze
apply
understand
remember
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh
Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test
Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate
Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state
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