NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Science and Engineering
(Data Science)
Academic Year 2023-24

3rd and 4th Semester Scheme & Syllabus

BATCH: 2022-26

CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING

VISION

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

MISSION

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

QUALITY POLICY

To provide 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 COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

PROGRAM OUTCOMES (POs)

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

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

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

PO4 Conduct Investigations of Complex Problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Apply Computer Science and Data Science principles, practices, and mechanisms to produce sustainable products and use knowledge in various domains to identify research gaps and hence provide solution to new ideas and innovations.
PSO2	Collaborate proficiently with experts from diverse fields and actively engage in continuous professional growth in the domain of computing.

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Computer Science and Engineering (DATA SCIENCE)
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

III 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	BSC	22MAC31	Mathematical Foundation for Computing Sciences	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	22CDS32	Advanced Data Structures	DS	3	0	0	0	3	3	50	50	**100**
3	PCCL	22CDL32	Advanced Data Structures Lab	DS	0	0	1	0	1	2	50	50	**100**
4	PCC	22CDS33	Database Management Systems	DS	3	0	0	0	3	3	50	50	**100**
5	PCCL	22CDL33	Database Management Systems Lab	DS	0	0	1	0	1	2	50	50	**100**
6	ESC	22CDS34X	Programming Language Course	DS	2	0	1	0	3	3	50	50	**100**
7	AEC	22CDS35X	Ability Enhancement Course – III		0	0	1	0	1	2	50	50	**100**
8	BSC	22BIK36	Bio Inspired Design and Innovation	Any Dept.	3	0	0	0	3	3	50	50	**100**
9	UHV	22UHK37	Universal Human Values And Life Skills	Any Dept	1	0	0	0	1	2	50	--	**50**
10	NCMC	22NSS30	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PEK30	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOG30	Yoga	Yoga Teacher									
Total									**19**	**25**	**500**	**400**	**900**
11	NCMC	22DMAT31*	Diploma Mathematics -1	BS	0	0	0	0	0	2	50	--	50

BSC: Basic Science Course, **PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering .**ESC:** Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

22DMAT31*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Programming Language Course(PLC)			
22CDS341	Linux System Programming	22CDS343	Advanced Excel for Data Science
22CDS342	Web Design Technologies	22CDS344	Ruby Programming

Ability Enhancement Course–III			
22CDS351	Python for Data Analytics	22CDS353	PHP Programming
22CDS352	Project Management with Git	22CDS354	GoLang Programming

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 Computer Science and Engineering (DATA SCIENCE)
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

IV 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	BSC	22MAC41	Discrete Mathematics and Graph Theory	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	22CDS42	Object Oriented Programming using Java	DS	3	0	0	0	3	3	50	50	**100**
3	PCCL	22CDL42	Object Oriented Programming using Java Lab	DS	0	0	1	0	1	2	50	50	**100**
4	PCC	22CDS43	Logic Design and Computer Organization	DS	3	0	0	0	3	3	50	50	**100**
5	PCCL	22CDL43	Logic Design Lab	DS	0	0	1	0	1	2	50	50	**100**
6	PCC	22CDS44	Operating Systems	DS	3	0	0	0	3	3	50	50	**100**
7	PCCL	22CDL44	Operating Systems Lab	DS	0	0	1	0	1	2	50	50	**100**
8	ESC	22CDS45X	Programming Language Course	DS	2	0	1	0	3	3	50	50	**100**
9	AEC	22CDS46X	Ability Enhancement Course – IV	DS	0	0	1	0	1	2	50	50	**100**
10	UHV	22SCK47	Social Connect and Responsibility	Any Dept	0	0	1	0	1	2	50	--	**50**
11	PROJ	22CDS48	Mini Project	DS	0	0	1	0	1	2	50	50	**100**
12	NCMC	22NSS40	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	--	**50**
		22PED40	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOG40	Yoga	Yoga Teacher									
Total									**21**	**29**	**600**	**500**	**1100**

13	NCMC	22DMAT41*	Diploma Mathematics -2	BS	0	0	0	0	0	2	50	--	50

BSC: Basic Science Course, **PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering. **ESC:** Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

22DMAT41*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Engineering Science Course / Emerging Technology Course / Programming Language Course(ESC/ETC/PLC)			
22CDS451	IoT Programming	22CDS453	Programming for UI and UX design
22CDS452	R Programming for Data Science	22CDS454	C# and .NET

Ability Enhancement Course–IV(For IT allied Branches, allareLaboratoryCourses0-0-1-0) (Other branches can have 1-0-0-0 or 0-0-1-0)			
22CDS461	Data Visualization with Tableau	22CDS463	Cloud-based Collaborative Workspace
22CDS462	Ethical Hacking Practices	22CDS464	File Structures

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by thedevelopmentofsmallsystems/applicationsetc.Basedontheability/abilitiesofthestudent/sandrecommendationsoftheme ntor. 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 ratioof50:25:25.Themarksawardedfortheproject report shall be the same for all the batch 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

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	02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
2-hours Tutorial(T) per week=1Credit	01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions
2-hours Practical / Drawing (P) per week=1Credit	
2-hous Self Study for Skill Development (SDA) per week = 1 Credit	

MATHEMATICAL FOUNDATION FOR COMPUTING SCIENCES (Common to AIM, CEE, CSE, CDS, ISE)

Course Code	**22MAC31**	**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:

22MAC31.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations.
22MAC31.2	Solve initial value problems using appropriate numerical methods and also Evaluate definite integrals numerically.
22MAC31.3	Demonstrate the idea of Linear Dependence and Independence of sets in the vector space.
22MAC31.4	Gain ability to use probability distributions to analyze and solve real time problems
22MAC31.5	Justify the concept of sampling distribution to solve the engineering problems.
22MAC31.6	Use the large/small samples to analyse the data to make decision about the hypothesis.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MAC31.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAC31.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAC31.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAC31.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAC31.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAC31.6	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**NUMERICAL METHODS-1**	**22MAC31.1**	**8 Hours**

Numerical solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson Method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference, Lagrange's formula and Lagrange's inverse interpolation for unequal intervals (without proofs)-Problems.

Case Study	Case study on Numerical Analysis.
Text Book	Text Book 1: 28.2, 28.3, 29.6, 29.10, 29.11, 29.13, Text Book 2: 19.2, 19.3.

MODULE-2	**NUMERICAL METHODS-2**	**22MAC31.2**	**8 Hours**

Numerical solution of ordinary differential equations of first order and of first degree: Taylor's series method, Modified Euler' method and Runge-Kutta method of fourth-order-Problems. Milne's predictor and corrector methods-Problems.
Numerical integration: Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule (without proofs)-Problems.

Applications	Application of numerical integration to velocity of a particle and volume of solids.
Text Book	Text Book 1: 32.3, 32.5, 32.7, 32.9, 30.7, 30.8, 30.10, Text Book 2: 19.5, 21.1.

MODULE-3	VECTOR SPACES	22MAC31.3	8 Hours
Vector Space definition and examples, Subspaces and Spanning sets, Linear Dependence and Independence, Linear Independence and Spanning Sets, Bases: Orthogonal and Ortho normal bases and Dimension.			
Text Book	Text Book 3: 4.1, 4.2, 4.3, 4.4, 4.5.		
MODULE-4	**PROBABILITY AND JOINT PROBABILITY DISTRIBUTIONS**	**22MAC31.4**	**8 Hours**
Random variables (discrete and continuous), probability density functions, moment generating function. Discrete Probability distributions: Binomial and Poisson Distributions-Problems. Continuous Probability distribution: Normal Distributions-Problems. Concept of joint probability-Joint probability distribution, Discrete and Independent random variables. Expectation, Covariance, Correlation coefficient.			
Case Study	Case study on Distributions.		
Text Book	Text Book 1: 26.8, 26.9, 26.10, 26.11, 26.12, 26.14, 26.15, 26.16.		
MODULE-5	**SAMPLING THEORY**	**22MAC31.5** **22MAC31.6**	**8 Hours**
Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, Inferences for variance and proportion. Central limit theorem (without proof), confidence limits for means, Student's t-distribution, F-distribution and Chi-square distribution for test of goodness of fit for small samples.			
Case Study	Case Studies on sampling theory and significant measures of scores.		
Text Book	Text Book 1: 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 27.10, 27.11, 27.12, 27.14, 27.15, 27.16, 27.19.		

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	-
L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3. David C Lay, Linear Algebra and its applications, Addison-Wesley Publishers, Fourth Edition, 2012, ISBN: 9780321385178.

Reference Books:

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN:9780273719236.
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/IgoJV4g_0LM?si=JO1_bkIvMR8xlC0V
2. https://youtu.be/mIFwzg11uO4?si=Xd13dh0eNlmIswPS
3. https://youtu.be/74g5_3TC-tQ?si=yB2PHVGr4hxIlqPo
4. https://youtu.be/QQFIWwDA9NM?si=3wJrtlm1NdPSbXmB
5. https://youtu.be/5817fLmsTGE?si=Y7ORyV2ETSCxZRAZ
6. https://youtu.be/q3xj16shDuw?si=ewdlKAC8UEc6oRQV
7. https://youtu.be/89Z0tOvHjNU?si=3jT-oriJZaC1kSzx
8. https://youtu.be/dOr0NKyD31Q?si=dMBU-BXGdGL6jIZy
9. https://youtu.be/BR1nN8DW2Vg?si=melzz97SqhK3wr--
10. https://youtu.be/ugd4k3dC_8Y?si=xF5U2gjIgP0woDQt
11. https://youtu.be/z0Ry_3_qhDw?si=6IG2a65BZgdbaKsn
12. https://youtu.be/36cAE1Ovpq4?si=jfR8gkFmMOCkWNZ_
13. https://youtu.be/vFz2FG65HBc?si=SCHi3Y1XuHWg-pPT
14. https://youtu.be/2Dsz1lZBJ3Y?si=8ATLUE-mkJSMewO3

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 Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

ADVANCED DATA STRUCTURES			
Course Code	**22CDS32**	**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:

22CDS32.1	Understand the fundamentals of data structures and their applications essential for Programming/problem solving.
22CDS32.2	Examine the operational aspects of linear data structures: stacks, queues in Problem solving.
22CDS32.3	Implement the linked list data structure in Problem solving.
22CDS32.4	Inspect the operational aspects of non-linear data structures: Trees, Graphs in Problem solving.
22CDS32.5	Apply appropriate data structures for a specified application.
22CDS32.6	Analyze the sorting algorithms and approximation 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
22CDS32.1	3	3	2	1	-	-	-	-	-	-	-	3	2	2
22CDS32.2	3	2	2	3	-	-	-	-	-	-	-	2	2	2
22CDS32.3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
22CDS32.4	3	2	2	3	-	-	-	-	-	-	-	2	2	2
22CDS32.5	3	3	3	3	-	-	-	-	-	-	-	3	2	2
22CDS32.6	3	3	1	2	-	-	-	-	-	-	-	2	2	2

MODULE-1	**BASIC CONCEPTS**	**22CDS32.1**	**8 Hours**

Data Structures, Classifications (Primitive &Non Primitive), Data Structure Operations, Review of Arrays, Strings, Structures, Self-Referential Structures, and Unions. Pointers -Pointer as function arguments, Dynamic Memory Allocation Functions, Sparse Matrix.

Text Book	Text Book 1: 2.1, 2.2,2.3 & Text Book 2:1.1-1.5,2.1-2.3

MODULE-2	**STACKS AND QUEUES**	**22CDS32.2**	**8 Hours**

Stacks, Applications of stacks: Recursion, Evaluation of Expressions, Factorial, Tower of Hanoi. Multiple Stacks. Queues: Queue representation, Primitive operations on queue, array representation of queues, Circular queue, Priority queue, Double ended queue, Applications of queues.

Text Book	Text Book 1:3.1,3.3,3.4Text Book 2: 4.5.1,4.5.3,4.5.4,4.5.6,5.1-5.4,6.4.1,6.4.3,6.4.4

MODULE-3	**LINKED LISTS**	**22CDS32.3**	**8 Hours**

Introduction to linked list, Representation of linked list in memory, primitive operations on linked list, searching a linked list, doubly linked list, header linked list, Linked representation of stack, Linked representation of queue, circular linked list-Polynomial Representation, Applications of Linked List.

Text Book	Text Book 1: 4.1,4.2,4.4,4.5,4.8

MODULE-4	**TREES**	**22CDS32.4**	**8 Hours**

Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps. Binary Search Trees, Selection Trees, Forests, Balanced Trees, AVL Trees, Single rotation, Double rotation, Splay Trees, Red-Black Trees.

Text Book	Text Book 1: 5.1,5.2,5.3,5.4,5.5,5.6, Text Book 2: 10.1, 10.3, 10.5, 10.7

MODULE-5	**GRAPHS AND SORTING**	**22CDS32.5, 22CDS32.6**	**8 Hours**

Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting-Internal Sorting, External Sorting, Insertion Sort, Selection Sort, Stable vs. Unstable sort, Linear Programming, Approximation Algorithms. Sets, Dictionaries, Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques.

Text Book	Text Book 1:6.1,6.2,7.1,8.1,8.2 & Text Book 2:10.1,10.2
Case Study / Applications	Create a menu driven travel application program and apply appropriate sorting techniques to retrieve and print the data. Further search the data based on the keywords.

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. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C. University Press, 2012.
2. Debasis Samanta: Classic Data Structures,2nd Edition, PHI, 2009.

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: "Data Structures using C and C++,2nd Edition, Pearson Education, 2003.
2. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning,2005.
3. Reema Thareja: "Data Structures Using C",Oxford university Press (2021).

Web links and Video Lectures (e-Resources):

1. https://www.udemy.com/course/datastructurescncpp/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106102064

Activity-Based Learning (Suggested Activities in Class)

- Case Studies
- Problem Solving Exercises
    - https://github.com/bollwarm/DataStructuresAlgorithms
    - https://www.hackerrank.com/domains/datastructures

ADVANCED DATA STRUCTURES LAB			
Course Code	**22CDL32**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CDL32.1	Apply the concepts of data structures that are essential for Programming and Problem Solving.
22CDL32.2	Examine the operational aspects of linear data structures: stacks, queues in Problem solving.
22CDL32.3	Implement the linked list data structure in Problem solving.
22CDL32.4	Inspect the operational aspects of non-linear data structures: Trees, Graphs in 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	PSO1	PSO2
22CDL32.1	3	3	2	1	1	-	-	-	-	-	-	3	2	2
22CDL32.2	3	2	2	3	1	-	-	-	-	-	-	2	2	2
22CDL32.3	2	2	2	2	2	-	-	-	-	-	-	3	2	2
22CDL32.4	3	2	2	3	2	-	-	-	-	-	-	2	2	2

Pgm. No.	List of Programs	Hours	COs
Prerequisite Programs			
	• Basic C Programs (Arrays, User defined Functions, Structures, Pointers) • Basic Commands in Linux	4	NA
	PART-A		
1	Design, Develop and Implement a menu driven Program in C for the following array operations. a. Creating an array of N Integer Elements b. Display of array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position (POS) e. Exit. Support the program with functions for each of the above operations.	2	22CDL32.1
2	Design, Develop and Implement a Program in C to create a structure to store the name, account number and balance of customers (more than 10) and store their information. 1 - Write a function to print the names of all the customers having balance lessthan$200. . 2 - Write a function to add $100 in the balance of all the customers having more than $1000 in their balance and then print the incremented value of their balance	2	22CDL32.1
3	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations	2	22CDL32.2
4	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.	2	22CDL32.2
5	Design, Develop and Implement a Program in C for the following Stack Application: Evaluation of Postfix expression with single digit operands and operators: +, -, *, /, %, ^.	2	22CDL32.2

6	Design, Develop and Implement a Program in C for the following Stack Application: Solving Tower of Hanoi problem with n disks.	2	22CDL32.2
PART-B			
7	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations	2	22CDL32.2
8	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit	2	22CDL32.3
9	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit	2	22CDL32.3
10	Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.	2	22CDL32.3
11	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit	2	22CDL32.4
12	Demonstrate binary search algorithm using anyone of the sorting techniques.	2	22CDL32.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. https://ds1-iiith.vlabs.ac.in/exp/poly-arithmetic/polynomial-arithmetic-linked-list/multiplication-of-polynomials.html : Implement polynomial multiplication using linked lists.
2. https://ds1-iiith.vlabs.ac.in/exp/depth-first-search/dfs/dfs-demo.html Implement Depth First Search in Graphs.
3. https://ds1-iiith.vlabs.ac.in/exp/depth-first-search/dfs/dfs-demo.htmlImplement Depth First Search in Graphs.
4. https://ds1-iiith.vlabs.ac.in/exp/hash-tables/hash-tables/hash-tables-operations.htmlDemonstrate Hash Table

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	10	10
L5	Evaluate	5	5
L6	Create		

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C. University Press, 2012.
2. Debasis Samanta: Classic Data Structures,2nd Edition, PHI, 2009.
3. Yedidyah, Augenstein, Tannenbaum: "Data Structures using C and C++,2nd Edition, Pearson Education, 2003.
4. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning,2005.
5. Reema Thareja: "Data Structures Using C", Oxford university Press (2021).

Web links and Video Lectures (e-Resources):

1. https://www.udemy.com/course/datastructurescncpp/
2. https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106102064

DATABASE MANAGEMENT SYSTEMS			
Course Code	**22CDS33**	**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:

22CDS33.1	Illustrate the ER model and relational data model to real word scenarios.
22CDS33.2	Interpret the DBMS components and concurrency control.
22CDS33.3	Analyze the database using relational algebra and query language.
22CDS33.4	Evaluate the database using SQL key constraints and nested queries and normalization techniques to refine databases.
22CDS33.5	Infer the concepts of joins and nested queries for various databases.
22CDS33.6	Apply the database processing techniques to ensure correctness through retrievals, insertions, deletions and updates.

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
22CDS33.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2
22CDS33.2	2	-	-	-	-	-	-	-	-	-	-	1	3	2
22CDS33.3	3	3	-	-	-	-	-	-	-	-	-	1	3	2
22CDS33.4	3	3	3	3	-	-	-	-	-	-	-	1	3	2
22CDS33.5	3	3	-	-	-	-	-	-	-	-	-	1	3	2
22CDS33.6	3	-	-	-	-	-	-	-	-	-	-	1	3	2

MODULE-1	**INTRODUCTION**	**22CDS33.1, 22CDS33.2**	**8 Hours**

Introduction to Database: Characteristics, advantages of DBMS Approach, Hierarchical, Network and Relational Models. Three-schema architecture and data independence, DBMS component modules, Database languages. Database design and ER Model: Introduction, ER-Model concepts, Constraints, weak entity types, notation for ER diagram, ER-Diagrams, mapping constraints.

Case Study	Create an ER diagram for a university management system involves defining entities like students, courses, professors, and departments, along with their relationships.
Text Book	Text Book 1: 1,2,3

MODULE-2	**RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA**	**22CDS33.1, 22CDS33.3**	**8 Hours**

Relational data model concepts, Relational model constraints and relational database schemas, Update operations, Transactions and dealing with constraints. Relational Algebra: Selection and projection, set operations, renaming, Joins, Division, Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus.

Case Study	Create a relational database for an Inventory Management System involves defining tables for Products, Suppliers, Orders, and Customers with appropriate constraints. Use relational algebra operations like selection, projection, and joins to manage data.
Text Book	Text Book 1: 5,8

MODULE-3	**SQL-1**	**22CDS33.3, 22CDS33.4**	**8 Hours**

Introduction, SQL data types, Data Definition Language (DDL), Data Manipulation Language (DML), keys, integrity rules, Integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints. Querying in SQL - basic select-from-where block and its semantics, Views.

Case Study	Design a hospital management system database includes tables for Patients, Doctors, Appointments, Medical Records, and Departments, with constraints to ensure data integrity. Use SQL statements (DDL, DML) to enable data management.
Text Book	Text Book 1: 6,7

MODULE-4	SQL-2 AND NORMALIZATION	22CDS33.4, 22CDS33.5	8 Hours

Joins and its types, Nested queries - correlated and uncorrelated, aggregation functions, group by and having clauses. Functional dependencies, features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).

Text Book	Text Book 1:7,14

MODULE-5	TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL	22CDS33.2, 22CDS33.6	8 Hours

Transaction processing and Error recovery - concepts of transaction processing, ACID properties, and serializability concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, and database recovery Management, RAID.

Text Book	Text Book 1: 21,22,23

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	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems" , Sixth Edition, Pearson / Addison - Wesley, 7th Edition 2021

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013.
2. Hector Garcia-Molina, Jeff Ullman, and Jennifer Wisdom, Database System, Pearson, 2nd EditionC.J. Date, An Introduction to Database Systems, 8th Edition.
3. Raghu Ramakrishnan, "Database Management Systems", Third Edition, McGraw Hill, 2013.

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

1. Self-study to explore various types of databases
2. Case Study- Designing a relational database for the given scenario
3. Problem solving activities (Activity-based discussions)

DATABASE MANAGEMENT SYSTEMS LAB

Course Code	**22CDL33**	**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:

22CDL33.1	Create a database as per the given requirements using DDL.
22CDL33.2	Manipulate the given database using DML.
22CDL33.3	Apply the concept of operators and functions for a given scenario using SQL.
22CDL33.4	Use nested and correlated queries to retrieve the data from the database.

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
22CDL33.1	3	3	3	3	3	-	-	-	-	-	-	1	3	2
22CDL33.2	3	3	3	3	3	-	-	-	-	-	-	1	3	2
22CDL33.3	3	3	3	3	3	-	-	-	-	-	-	1	3	2
22CDL33.4	3	3	3	3	3	-	-	-	-	-	-	1	3	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Common set of operations to be carried out for all the experiments: • Creation of tables, insertion of values with Data Definition Commands (use constraints while creating tables) and exercises on Data Manipulation Commands. • Developing Queries using clauses SELECT, FROM, WHERE, GROUP BY, HAVING.	2	
	PART-A		
1	Introduction to SQL Commands: DDL (Data Definition Language), Implementation of Create, Alter, Drop, rename, truncate	2	22CDL33.1
2	DML(Data Manipulation Language):Implementation of Select, Insert, Update, Delete. Retrieval of data from a single table using simple queries	2	22CDL33.2
3	Implementation of relational and logical operators	2	22CDL33.3
4	Implementation of SQL Functions	2	22CDL33.4
5	Implementation of Constraints: NOT NULL, Primary Key, Foreign Key, Unique. Combining tables and execution of queries on such tables.(Group by and Having Clause),(Create views and triggers)	2	22CDL33.3
6	Create department table with the following structure. Name – Type; DeptNo. – Number; DeptName – Varchar2(20); Location – Varchar2(20) 1. Calculate the average salary for each different job. 2. Show the average salary of each job excluding manager. 3. Show the average salary for all departments employing more than three people. 4. Display employees who earn more than the lowest salary in department 30 5. Show that value returned by sign (n) function. 6. How many days between day of birth to current date	2	22CDL33.3
	PART-B		

7	**Consider the following schema for a Library Database:** BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Programme_id, No-of_Copies) BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME (Programme_id, Programme_Name, Address) 1. Insert at least 5 records for each table. Add appropriate database constraints 2. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Program, etc. 3. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 4. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 5. Create a view of all books and its number of copies that are currently available in the Library.	2	22CDL33.3 22CDL33.4
8	**Consider the following schema for Order Database:** SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade,Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to 1. Insert at least 5 records for each table. Add appropriate database constraints 2. Count the customers with grades above Bangalore's average. 3. Find the name and numbers of all salesmen who had more than one customer. 4. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) 5. Create a view that finds the salesman who has the customer with the highest order of a day. 6. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.	2	22CDL33.3 22CDL33.4
9	**Consider the schema for Movie Database:** ACTOR (Act_id, Act_Name, Act_Gender) DIRECTOR (Dir_id, Dir_Name, Dir_Phone) MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST (Act_id, Mov_id, Role) RATING (Mov_id, Rev_Stars) Insert at least 5 records for each table. Add appropriate database constraints. Write SQL queries to 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5	2	22CDL33.3 22CDL33.4
10	**Consider the schema for College Database:** STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) SUBJECT (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Insert at least 5 records for each table. Add appropriate database constraints Write SQL queries to	2	22CDL33.3 22CDL33.4

	1. List all the student details studying in fourth semester 'C'section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects. 4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT ='Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA< 12 then CAT = 'Weak' Give these details only for 8th semester A, B, and C section students.		
11	EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) Insert at least 5 records for each table. Add appropriate database constraints Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5. (use NOT EXISTS operator). For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000	2	22CDL33.3 22CDL33.4
12	**CASE STUDY: GENERAL HOSPITAL** A General Hospital consists of a number of specialized wards (such as Maternity, Pediatric, Oncology, etc). Each ward hosts a number of patients, who were admitted on the recommendation of their own GP and confirmed by a consultant employed by the Hospital. On admission, the personal details of every patient are recorded. A separate register is to be held to store the information of the tests undertaken and the results of a prescribed treatment. A number of tests may be conducted for each patient. Each patient is assigned to one leading consultant but may be examined by another doctor, if required. Doctors are specialists in some branch of medicine and may be leading consultants for a number of patients, not necessarily from the same ward. **Lab Assignment:** 1. Analyze the data required. 2. Normalize the attributes. 3. Create the logical data model using E-R diagrams	2	22CDL33.3 22CDL33.4

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.ernet.in/se/4/case_study: Develop a conceptual schema for Library Information System
2. http://vlabs.iitkgp.ernet.in/se/4/case_study : Create and manipulate the database for Student Information System
3. http://vlabs.iitkgp.ernet.in/se/4/exercise

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	-	-
L3	**Apply**	10	10
L4	**Analyze**	**5**	10
L5	**Evaluate**	**5**	10
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. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems" , Sixth Edition, Pearson / Addison - Wesley, 7th Edition 2021
2. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013.

LINUX SYSTEM PROGRAMMING			
Course Code	**22CDS341**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CDS341.1	Understand the fundamentals of Multi-User Operating system and commands.
22CDS341.2	Apply the file manipulation commands and file APIs.
22CDS341.3	Analyze the mechanism of process creation and process APIs.
22CDS341.4	Relate the networking commands and IPC mechanism.
22CDS341.5	Implement shell scripts effectively.
22CDS341.6	Examine awk programs for various real-time applications.

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
22CDS341.1	3	2	2	2	-	-	-	-	-	-	-	2	3	3
22CDS341.2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
22CDS341.3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS341.4	2	3	3	3	-	-	-	-	-	-	-	2	3	3
22CDS341.5	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22CDS341.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3

MODULE-1	**GENERAL PURPOSE UTILITIES**	**22CDS341.1**	**8 Hours**

Getting Started & Understanding LINUX Commands: LINUX Operating System, LINUX architecture, Features of LINUX, The POSIX Standards, API Common Characteristics.

General Purpose Utilities: passwd, who, tty, lock, sty, script, clear and tput, uname, date, cal, calendar, bc, man, echo, script, passwd, uname, who ,date.

Laboratory Component:

1. Execution of various general purpose utility commands
2. Execution of various filter commands
3. Execution of various file/directory handling commands

Text Book	Text Book 1 Chapter 1 ,2

MODULE-2	**FILE SYSTEM AND ATTRIBUTES**	**22CDS341.2**	**8 Hours**

File System and Attributes: Introduction to LINUX file system, inode, File Types, File Attributes, Application program Interface to Files, LINUX kernel support for files.

File Handling Commands: ls, cat, cp, mv, rm, wc, od, printf,pwd, mkdir, rmdir, cd, file and directory permissions-chmod,fileownership-chown,chgrp,umask,tar,gzip,unlink,du,df, find, file modification and access times-touch.

Laboratory Component:

1. Write a program to emulate the ln command.
2. Write a program to read the alternate nth byte and writeit in another file
3. Write a program that creates a zombie and then calls system to execute the ps command to verify that the process is zombie.

Text Book	Text Book 1 Chapter 3,4

MODULE-3	**PROCESS**	**22CDS341.3**	**8 Hours**

PROCESS: Process,LINUXkernelsupportforprocesses,processattributes,processtable,viewingprocesses–ps,systemprocesses,startingnewprocesses,waitingforaprocess, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec .

Laboratory Component:

1. Write a program to implement the system function.
2. Writeaprogramwhichdemonstratesinter-processCommunicationbetweenareaderprocessandawriterprocess.
3. Write a shell script to accept a file and check If it Is executable. If not make it executable.

Text Book	Text Book 1 , Chapter 5,6 Text Book 2 Chapter 3 ,4		
MODULE-4	**NETWORKING COMMANDS**	**22CDS341.4**	**8 Hours**

Networking commands: ifconfig, ulimit, finger, arp, ftp, telnet, hostname, trace route, ping, netstat, nslookup

Inter Process Communication: Pipe, process pipes, pipecall, Named Pipes – FIFO, Message Queues – msgget, msgsnd, msgrcv, msgctl

Laboratory Component:

1. Write a shell scrip to accept a file and check if it is executable. If not make it executable.
2. Write a shells cript which displays a list of all the files in the current directory to which you have read, write and execute permissions.
3. Write a shell script which gets executed the moment the user logsin.It should display the message, "GoodMorning", "GoodAfternoon", " Good Evening", depending upon the time at which the user logs in.

Text Book	Text Book 1, Chapter 7 ,8		
MODULE-5	**SHELL & AWK PROGRAMMING**	**22CDS341.5, 22CDS341.6**	**8 Hours**

Shell Programming: Shell variables, shellscripts, read, positional parameters, exit status, logical operators, exit, if conditions, test and [], case, expr, sleep and wait, while and for.

AWK Programming: Splitting line into fields, printf–formatting output, comparison operators, number processing, BEGIN and END section, positional parameters, getline, built-invariables and functions.

Laboratory Component:

1. Write a script to demonstrate built-invariables available in AWK
2. Write a script to demonstrate builtin functions available in AWK
3. Write a shell script which accepts any number of arguments and prints the min reverseorder

Text Book	Text Book 2 Chapter 5,6,7

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		**Marks Distribution**		
		Test (s)	**Qualitative Assessment**	**Lab**
		25	**05**	**20**
L1	**Remember**	5	-	-
L2	**Understand**	5	2	-
L3	**Apply**	5	3	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. Linux for Beginners: A Practical and Comprehensive Guide to Learn Linux, Ethem Mining,ISBN:978-1671228085, 2019.
2. Your UNIX–The ultimate Guide, SUMITABHADAS, TATA McGraw Hill Edition, 4th Edition Paperback2017, McGrawHill, ISBN:978-0070446878

Reference Books:

1. UNIX System Programming Using C++, Terrence Chan, Prentice-Hall of India Private Limited, ISBN: 978-332549975, 2015.
2. Advanced Programming in the UNIX Environment, W Richard Stevens and Stephen A Rago, Addison Wesley Publications, Third Edition, 2013, ISBN: 978-0321637734.
3. UNIX and SHELL Programming, Richard F Gilberg and Behrouz A Forouzan, 15th impression, 2015, Cengage Learning, ISBN: 978-8131503256

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/117106113
2. https://web.njit.edu/~alexg/courses/cs332/OLD/F2020/hand3f20/Linux-Tutorial.pdf
3. https://www.youtube.com/watch?v=8lwxOAecpLQ

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

1. Online tests to enhance learning [https://app.staging.testdome.com/screening/challenge/81?hard=false - Certificate for top 25% will be issued]
2. Practical Based learning like “creating and configuring a monitoring system in Linux” ,”web programming with Linus OS”.

WEB DESIGN TECHNOLOGIES			
Course Code	**22CDS342**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CDS342.1	Understand the syntax and semantics of designing the web pages using XHTML and HTML5.
22CDS342.2	Apply Cascading Style Sheets to format the layout of webpages.
22CDS342.3	Develop JavaScript programs to validate and create dynamic Web Pages.
22CDS342.4	Develop server side programs using PHP and accessing database through PHP.
22CDS342.5	Describe the methods to handle data through the web and design XML document.
22CDS342.6	Inspect the management of state in web applications and Java Script frameworks likejQuery and Backbone which facilitates developer to focus on core features.

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
22CDS342.1	2	2	2	1	2	-	-	-	-	-	-	1	2	2
22CDS342.2	2	2	2	1	2	-	-	-	-	-	-	2	2	2
22CDS342.3	3	2	2	3	2	-	-	-	-	-	-	2	2	2
22CDS342.4	3	2	2	1	3	-	-	-	-	-	-	2	2	2
22CDS342.5	3	2	2	2	2	-	-	-	-	-	-	2	2	2
22CDS342.6	3	2	2	2	3	-	-	-	-	-	-	3	2	2

MODULE-1	**XHTML**	22CDS342.1, 22CDS342.2	**8 Hours**

Basic syntax, Standard XHTML document structure; Basic text markup, Images; Hypertext Links, Lists, Tables, Forms, Syntactic differences between HTML and XHTML .**Cascading Style Sheets:** Introduction, Levels of style sheets, Style specification formats, Selector forms, The Box model, Background images, The and tags, Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements.

Laboratory Component:

1. Develop and demonstrate a XHTML file that creates a college web site with forms, frames, links, tables.
2. Design a Shopping web site using HTML and DHTML. Use Basic text Formatting, Images.
3. Design a Ticket Booking Web site using XHTML, Use various level of CSS.

TEXTBOOK	TEXTBOOK 1 : 2.1- 2.9 TEXTBOOK 1 : 3.1- 3.13

MODULE-2	**HTML 5**	22CDS342.1	**8 Hours**

Detecting HTML 5 features – Canvas, video, local storage, web workers, offline applications, geo-location, input types. What does itall mean – doctype, root, headers, articles, dates and times, navigation and footers. Let's call it drawing surface - Simple shapes, canvas, Paths, texts, gradients and images. A Form of madness.

Laboratory Component:

1. Develop and demonstrate a XHTML file with Canvas and local storage concepts.
2. Develop and demonstrate XHTML Sections.
3. Develop and demonstrate a XHTML file that creates a Computer Science Book repository web site with XHTML forms. When a user enters the specific book with an ID or Title the contents of the book to be retrieved.

TEXTBOOK	TEXTBOOK 3 : Chapter 2,3,4,9

MODULE-3	JAVASCRIPT	22CDS342.3	8 Hours

Overview of JavaScript, General syntactic characteristics, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructor, Pattern matching using regular expressions.

JavaScript and DHTML Documents: The Document Object Model, Element access in JavaScript, Events and event handling. Moving elements, Element visibility, Dynamic content, Slow movement of elements.

Laboratory Component:

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:

a) Input: A number n obtained using prompt
Output: The first n Fibonacci numbers

b) Input: A number n obtained using prompt
Output: A table of numbers from 1 to n and their squares using alert box.

2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed bytwo digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.

b) Modify the above program to get the current semester also (restricted to be a number from 1 to8)

3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.

b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.

TEXTBOOK	TEXTBOOK 1 : 4.1- 4.12, TEXTBOOK 1 : 5.1- 5.4, TEXTBOOK 1 : 6.1- 6.10

MODULE-4	PHP Programming	22CDS342.4	8 Hours

Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

Laboratory Component:

1. 1. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
2. 2. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
3. 3. Write a PHP program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.

TEXTBOOK	TEXTBOOK 1 : 9.1- 9.12, TEXTBOOK 1 : 13.5

MODULE-5	XML	22CDS342.5, 22CDS342.6	8 Hours

Introduction to XML, The Syntax of XML, Document structure, Document Type Definition (DTD), Displaying XML documents with CSS, XSLT style sheets.

Managing State, Passing Information via Query Strings, Passing Information via the URL Path, Serialization, jQuery Foundations, AJAX, Animation, JSON.

Laboratory Component:

1. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include 100 USN, Name, Name of the College, Brach, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
2. Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.
3. Demonstrate jQuery serialize() method.

TEXTBOOK :	TEXTBOOK 1 : 7.1- 7.9, TEXTBOOK 1 : chapter 10

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	2	-
L3	Apply	5	3	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. RobertW.Sebesta,"ProgrammingtheWorldWideWeb",8th Edition,PearsonEducation, 2015.
2. RandyConnolly,RicardoHoar,"FundamentalsofWebDevelopment",4st Edition,PearsonEducation India, 2016
3. MarkPilgrim,"HTML5:UpandRunning:DiveintoHTML5",1st EditionO'Reilly,Google Press Publishers & Distributors Pvt Ltd, 2010

Reference Books:

1. Paul Deitel, HarveyDeitel, Abbey Deitel, "Internet & World Wide Web Howtoprogram", 5th Edition, Pearson Education/PHI, 2012.
2. Erik Bruchez, Danny Ayers, Eric Van Der Vlist, "Professional Web 2.0 Programming",1st Edition, Wiley India Pvt. Ltd, 2014.
3. Randal L. Schwartz, brian d foy, Tom Phoenix, "Learning Perl " 6th Edition, Released June 2011,Publisher(s): O'Reilly Media, Inc., ISBN: 9781449303587

Web links and Video Lectures (e-Resources):

1. https://developer.mozilla.org/en-US/docs/Web/XML/XML_introduction
2. https://www.browserstack.com/guide/top-html5-features
3. https://www.w3schools.com/php/php_intro.asp
4. https://www.w3schools.com/js/js_operators.asp
5. https://onlinecourses.swayam2.ac.in/aic20_sp11/preview

ADVANCED EXCEL FOR DATA SCIENCE			
Course Code	**22CDS343**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CDS343.1	Understand to the use of Excel spreadsheets and various basic data functions of Excel.
22CDS343.2	Demonstrate the operations related to Columns & Rows.
22CDS343.3	Demonstrate SPSS and its operations, representing data diagrammatically and graphically using MS-EXCEL and SPSS.
22CDS343.4	Compute absolute and relative measures of central tendency and dispersion, correlation and regression analysis using MS-EXCEL and SPSS.
22CDS343.5	Understand the concepts related to hypothesis, computation of large sample tests using MS-EXCEL and SPSS.
22CDS343.6	Identify and compute small sample tests, Chi-square tests using MS-EXCEL and SPSS.

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
22CDS343.1	3	3	3	2	-	-	-	-	-	-	-	2	2	2
22CDS343.2	2	2	3	3	-	-	-	-	-	-	-	2	2	2
22CDS343.3	2	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS343.4	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS343.5	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS343.6	2	3	3	3	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Introduction to Excel**	**22CDS343.1**	**8 Hours**

About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets.

Laboratory Component: (Programs)

1. Apply the Basic functions in Excel, arithmetic functions.
2. Apply the various logical functions.
3. Using formulas in Excel and their copy and paste using absolute and relative referencing.

TEXT BOOK:	TEXT BOOK 1: Chapter 1

MODULE-2	**Columns & Rows**	**22CDS343.2**	**8 Hours**

Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special

Laboratory Component: (programs)

1. Apply the concept to Change the Column Width & Row Height.
2. Apply the concept to Hide/Unhide Columns & Rows.
3. Create a new row &Column and delete a row &Column.

TEXT BOOK:	TEXT BOOK 1: Chapter 2

MODULE-3	**SPREADSHEET FUNCTIONS TO ORGANIZE DATA**	**22CDS343.3, 22CDS343.4**	**8 Hours**

Various Excel functions to organize and query data. Learners are introduced to the IF, nested IF, VLOOKUP and the HLOOKUP functions of Excel. Concatenate, Match, Countif, Text, Trim.

Laboratory Component: (programs)

1. Apply IF and the nested IF functions
2. Apply VLOOKUP and HLOOKUP.
3. Apply The RANDBETWEEN function.

TEXT BOOK:	TEXT BOOK 1: Chapter 2

MODULE-4	**INTRODUCTION TO FILTERING, PIVOT TABLES, AND CHARTS**	**22CDS343.5**	**8 Hours**

Various data filtering capabilities of Excel, filters in data to selectively access data, the Pivot Table. Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table.

Laboratory Component: (programs)

1. Usage of Data filtering in Excel.
2. Use of Pivot tables with categorical as well as numerical data.
3. Create the different types of charts.

TEXT BOOK:	TEXT BOOK 1: Chapter 3

MODULE-5	**SPREADSHEET TOOLS**	**22CDS343.6**	**8 Hours**

Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between Spreadsheets, Hiding and Protecting worksheets.

Laboratory Component: (programs)

1. Moving between one Spreadsheet to another and Copying and Pasting Data between Spreadsheets.
2. Apply the concept of Inserting & Deleting Spreadsheets and Renaming Spreadsheets.
3. Usage of Splitting the Screen, Freezing Panes.

TEXT BOOK:	TEXT BOOK 1: Chapter 5

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		**Marks Distribution**		
		Test (s)	**Qualitative Assessment**	**Lab**
		25	**05**	**20**
L1	**Remember**	5	-	-
L2	**Understand**	5	2	-
L3	**Apply**	5	3	10
L4	**Analyze**	5	-	10
L5	**Evaluate**	5	-	-
L6	**Create**	-	-	-

SEE Assessment Pattern (50 Marks – Theory)–

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

Suggested Learning Resources:

Text Books:

1. Data Analysis with Microsoft Excel Paperback – Import, 25 March 2003 by K. Berk (Author), Partrick Carey (Author)
2. Excel 2019 Bible, Michael Alexander, 1st edition, John Wiley & Sons Inc, ISBN: 9781119514787.

Reference Books:

1. Richard Levin & David S.Rubin (2012): Statistics for Management, 7th Edition, Pearson.
2. J K Sharma (2012): Business statistics, Second Edition- Pearson Education.
3. Andy field (2013): Discovering statistics using IBM SPSS statistics, 4th Edition , SAGE Publications.
4. Cunningham, B.J (2012):Using SPSS: An Interactive Hands-on Approach.
5. K.V.S. Sarma: Statistics made simple: do it yourself on PC. PHI

Web links and Video Lectures (e-Resources):

1. https://www.coursera.org/learn/excel-data-analysis#syllabus
2. https://www.udemy.com/course/data-analytics-in-excel/
3. Excel Data Analytics Full Course | Essential Skills For Data Analysis In Excel | Simplilearn, https://www.youtube.com/watch?v=OOWAk2aLEfk
4. Beginner to Pro FREE Excel Data Analysis Course, https://www.youtube.com/watch?v=v2oNWja7M2E&list=PLmejDGrsgFyBCxF37lewZtX6c1kJXyLt3

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 various charts and Handouts.
- Organizing Group wise discussions on issues

RUBY PROGRAMMING			
Course Code	**22CDS344**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CDS344.1	Understand the fundamentals of Ruby Programming essential for problem solving.
22CDS344.2	Examine the operational aspects of Strings and Arrays in Ruby Programming
22CDS344.3	Inspect the concept of Classes and Objects in Ruby Programming.
22CDS344.4	Analyze the Web-App Framework of Ruby on Rails.
22CDS344.5	Understand Ruby Tk Programming.
22CDS344.6	Examine the concepts of extended Ruby programming.

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
22CDS344.1	3	3	3	3	1	-	-	-	-	-	-	2	2	2
22CDS344.2	3	3	3	3	1	-	-	-	-	-	-	2	2	2
22CDS344.3	3	3	3	3	1	-	-	-	-	-	-	2	2	2
22CDS344.4	3	3	3	3	1	-	-	-	-	-	-	2	2	2
22CDS344.5	3	3	3	3	1	-	-	-	-	-	-	2	2	2
22CDS344.6	3	3	3	3	1	-	-	-	-	-	-	2	2	2

MODULE-1	**Introduction to Ruby Programming**	**22CDS344.1**	**8 Hours**

Ruby –Overview, Syntax, Variables, Operators, Comments, Control Statements, Loops, Methods, Blocks, Modules.

Laboratory Component: (programs)

1. Write Ruby program to get ruby version with patch number.
2. Write a Ruby program to display the current date and time.
3. Write a Ruby program which accept the radius of a circle from the user and compute the parameter and area.

TEXT BOOK:	TEXT BOOK 1: Chapter 1

MODULE-2	**Strings-Arrays , Classes and Objects**	**22CDS344.2**	**8 Hours**

Strings, Arrays, Ruby Classes and Objects, Defining Methods, new method, Creating Objects, Creating Objects using Custom Methods in Ruby, Member Functions in Ruby Classes.

Laboratory Component: (programs)

1. Write a Ruby program to create a new string which is n copies of a given string where n is a non-negative integer.
2. Write a Ruby program to check whether a string 'Ruby' appears at index 1 in a given sting, if 'Ruby' appears return the string without 'Ruby' otherwise return the string unchanged.
3. Write a Ruby program which accept the user's first and last name and print them in reverse order with a space between them.

TEXT BOOK:	TEXT BOOK 1: Chapter 5 ,6

MODULE-3	**Ruby and Rails**	**22CDS344.3, 22CDS344.4**	**8 Hours**

Ruby, Rails, The structure and Execution of Ruby Programs, Package Management with RUBYGEMS, Ruby and web: Writing CGI scripts, cookies, Choice of Webservers, SOAP and web services.

Laboratory Component: (programs)

1. Write a Ruby program to create a class with data members and initialize using initialize ( ) method
2. Write a Ruby program to initialize instance variables using the constructor.
3. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

TEXT BOOK:	TEXT BOOK 1: Chapter 16

MODULE-4	Introduction to Ruby Tk	22CDS344.5	8 Hours

RubyTk – Simple Tk Application, widgets, Binding events, Canvas, scrolling.

Laboratory Component: (programs)

1. Demonstrate Ruby/Tk Widget Classes
2. Demonstrate Standard Configuration Options
3. Demonstrate Ruby/Tk Event Handling

TEXT BOOK:	TEXT BOOK 1: Chapter 8

MODULE-5	Extending Ruby	22CDS344.6	8 Hours

Ruby Objects in C, the Jukebox extension, Memory allocation, Ruby Type System, Embedding Ruby to Other Languages, Embedding a Ruby Interpreter.

Laboratory Component: (programs)

1. Write a Ruby program to check whether the sequence of numbers 10, 20, 30 appears anywhere in a given array of integers.
2. Demonstrate Memory allocation functions.
3. Demonstrate Embedding Ruby Interpreter.

TEXT BOOK:	TEXT BOOK 1: Chapter 16

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	2	-
L3	Apply	5	3	10
L4	Analyze	5	-	10
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)–

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

Suggested Learning Resources:

Text Books:

1. Ruby Programming for Beginners: An Introduction to Learning Ruby Programming with Tutorials and Hands-On Examples Kindle Edition by Nathan Metzler (Author).
2. The Ruby Programming Language: Everything You Need to Know 1st Edition by David Flanagan (Author), Yukihiro Matsumoto (Author).

Web links and Video Lectures (e-Resources):

1. https://www.classcentral.com/classroom/freecodecamp-ruby-programming-language-full-course-58000
2. https://www.codecademy.com/learn/learn-ruby
3. https://www.udemy.com/course/ruby-for-absolute-beginners/

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

1. Contents related activities (Activity-based discussions)
   - For active participation of students, instruct the students to demonstrate mini projects.[Building product catalogue and shopping cart]

PYTHON FOR DATA ANALYTICS			
Course Code	**22CDS351**	**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:

22CDS351.1	Demonstrate the basics of Python Programming.
22CDS351.2	Apply inheritance and overloading for the given problem.
22CDS351.3	Analyzing the data for missing value and correlation among the parameters considered with essential operations from python libraries.
22CDS351.4	Demonstrate the concept of Data Visualization using Python libraries.

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
22CDS351.1	3	3	3	2	3	-	-	-	-	-	-	2	3	3
22CDS351.2	3	3	3	2	3	-	-	-	-	-	-	2	3	3
22CDS351.3	3	3	3	2	3	-	-	-	-	-	-	2	3	3
22CDS351.4	3	3	3	2	3	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	• Basics of Python Programming • Programs dealing with libraries: NumPy, Pandas, Matplotlib, SciPy, Scikit-Learn.	2	NA
	PART-A		
1	Write a python program to find sum of n natural numbers using recursive function.	2	22CDS351.1
2	Write a Python Program to Create a Dictionary with Key as First Character and Value as Words Starting with that Character.	2	22CDS351.1
3	Implement a Python program to count the numbers of characters in the string and store them in a dictionary data structure	2	22CDS351.1
4	Design and Develop a Python Program to Append, Delete and Display Elements of a List Using Classes and Objects.	2	22CDS351.2
5	Demonstrate the concept of Method Resolution order in multiple inheritance in Python Program.	2	22CDS351.2
6	Design and Implement a Python Program to perform addition, subtraction, multiplication of two complex numbers using binary operators overloading.	2	22CDS351.2
	PART-B		
7	Demonstrate with a python program to show the speed of execution is more when using numpy array.	2	22CDS351.3
8	Write a program to read the data and perform correlation, Two way conditional probability, joint probability and marginal probability.	2	22CDS351.3
9	Write a program to analyse the given data and perform the operation to find the missing data.	2	22CDS351.3
10	Read the data set and perform scatter plot, Histogram and Bar plot using Matplotlib in libraries.	2	22CDS351.4
11	Read the data set and perform scatter plot, Histogram and Bar plot s using seaborn library.	2	22CDS351.4
12	Read the data set and perform Box and whiskers plot using seaborn library.	2	22CDS351.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://www.simplilearn.com/tutorials/data-analytics-tutorial/data-analytics-with-python.**
2. **https://python-iitk.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	10	15
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	05
L3	Apply	15
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Publisher: Shroff/ O'Reilly Publishers, 2nd edition, 2022, ISBN-10: 1636390471, ISBN-13: 978-1636390475
2. Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.
3. Jake Vander plas, "Python Data Science Handbook: Essential tools for working with data", O'Reilly Publishers, I Edition.
4. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012Mark Lutz, "Programming Python", O'Reilly Media, 4th edition, 2010.
5. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, 1st edition, 2009.
6. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005.
7. ShaiVaingast, "Beginning Python Visualization Crafting Visual Transformation Scripts", Apress, 2nd edition, 2014

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc23_cs99/preview
2. https://www.youtube.com/watch?v=_uQrJ0TkZlc
3. https://www.python.org/

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

1. Demonstration of mini projects using python for Data Analytics for .[Exploring Data, Handling missing data for IRIS and Hosing data]

PROJECT MANAGEMENT WITH Git			
Course Code	**22CDS352**	**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:

22CDS352.1	Demonstrate the basic command of Git and manage branches in Git.
22CDS352.2	Apply the process of collaborating and working with remote repositories.
22CDS352.3	Inspect the advanced Git operations.
22CDS352.4	Analyze the version controlling commands in Git.

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
22CDS352.1	2	2	2	2	2	-	-	-	-	-	-	**3**	**3**	**3**
22CDS352.2	3	3	3	3	2	-	-	-	-	-	-	3	3	3
22CDS352.3	2	2	2	2	2	-	-	-	-	-	-	3	3	3
22CDS352.4	2	3	3	3	2	-	-	-	-	-	-	3	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	1. Software Development Process 2. A command line interface. 3. A text editor of your choice (VS Code). **4.** A GitHub account.	2	NA
	PART-A		
1	Initialize a new Git repository in a directory. Create a new file and add it to the staging areaand commit the changes with an appropriate commit message.	2	22CDS352.1
2	Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."	2	22CDS352.1
3	Write the commands to stash your changes, switch branches, and then apply the stashed changes.	2	22CDS352.1
4	Clone a remote Git repository to your local machine.	2	22CDS352.2
5	Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.	2	22CDS352.2
6	Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.	2	22CDS352.2
	PART-B		
7	Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.	2	22CDS352.3
8	Write the command to cherry-pick a range of commits from "source-branch" to the current branch.	2	22CDS352.3
9	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	22CDS352.4
10	Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."	2	22CDS352.4
11	Write the command to display the last five commits in the repository's history.	2	22CDS352.4
12	Write the command to undo the changes introduced by the commit with the ID "abc123"	2	22CDS352.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://github.com/topics/virtual-lab**

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	15
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
2. Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://gitscm.com/book/en/v2

Web links and Video Lectures (e-Resources):

1. Ben Straub and published by Apress, https://gitscm.com/book/en/v2
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_share d /overview.
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_shar e d/overview.

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

- Group activity for uploading files/programs and manage version control in GIT

PHP PROGRAMMING			
Course Code	**22CDS353**	**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:

22CDS353.1	Apply the basic syntax and semantics of PHP Programming.
22CDS353.2	Demonstrate the concepts of control structures, structured data (object) and data items (array) in PHP.
22CDS353.3	Examine the file handling mechanism and regular expressions concept in PHP.
22CDS353.4	Inspect basic concepts of PHP to develop web program.

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
22CDS353.1	3	2	2	2	2	1	-	-	-	-	-	2	2	2
22CDS353.2	3	2	2	2	2	1	-	-	-	-	-	2	2	2
22CDS353.3	3	2	2	2	2	1	-	-	-	-	-	2	2	2
22CDS353.4	3	2	2	2	2	1	-	-	-	-	-	2	2	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	• Basics of Programming	2	NA
	PART-A		
1	Develop a PHP program to calculate areas of Triangle and Rectangle.	2	22CDS353.1
2	Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients. Print the appropriate messages.	2	22CDS353.1
3	Demonstrating the various forms to concatenate multiple strings Develop program(s) to demonstrate concatenation of strings: (i) Strings represented with literals (single quote or double quote) (ii) Strings as variables (iii) Multiple strings represented with literals (single quote or double quote) and variables (iv) Strings and string variables containing single quotes as part string contents (v) Strings containing HTML segments having elements with attributes	2	22CDS353.2
4	Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100)and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and19, etc. The last "box" in the histogram should include scores between 90 and 100. Use a function togenerate the histogram.	2	22CDS353.2
5	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID, Emp_Dept, Emp_Salary, and Emp_DOJ.	2	22CDS353.2
6	a. Develop PHP program to demonstrate the date() with different parameter options. b. Develop a PHP program to generate the Fibonacci series using a recursive function.	2	22CDS353.2
	PART-B		
7	Develop a PHP program to accept the file and perform the following (i) Print the first N lines of a file (ii) Update/Add the content of a file	2	22CDS353.3
8	Develop a PHP program to read the content of the file and print the frequency of occurrence of the word accepted by the user in the file.	2	22CDS353.3

9	PHP program to check a case insensitive substring exists within the given string using regular expression pattern.	2	22CDS353.3
10	Develop a PHP program to find the occurrences of a given pattern and replace them with a text	2	22CDS353.3
11	Develop a PHP program to count the occurrences of Aadhaar [numbers present in a text.	2	22CDS353.3
12	Develop a PHP program to read the contents of a HTML form and display the contents on a browser	2	22CDS353.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. [https://html-iitd.vlabs.ac.in/List%20of%20experiments.html]: Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.
2. [https://html-iitd.vlabs.ac.in/List%20of%20experiments.html] : Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.[

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	15
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. Programming in HTML and PHP (Coding for Scientists and Engineers, BY DEVID R BROOKS, Springer International Publishing AG 2017
2. PHP: Expertise in PHP: A Step-by-Step Guide to Advanced PHP Programming Concepts, Ananya Gupta, Kindle Edition.
3. The Complete Reference PHP, Steven Holzner, Mc Graw Hill, ISBN: 9780070223622,

Web links and Video Lectures (e-Resources):

1. https://www.w3schools.com/php/
2. https://www.tutorialspoint.com/php/index.htm
3. https://www.w3schools.com/html/

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

1. Web applications with three tier architecture in groups.

GOLANG PROGRAMMING			
Course Code	**22CDS354**	**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:

22CDS354.1	Apply the basic programming Go Lang constructs to develop standalone applications.
22CDS354.2	Apply the concept of functions and recursive functions in GoLang programming
22CDS354.3	Develop applications using GoRoutines and channels
22CDS354.4	Solve the real-world concurrency issues using concurrency with go concepts.

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
22CDS354.1	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS354.2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS354.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
22CDS354.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	• **Hello World program in GoLang and Editors fro GoLang Programming**	2	NA
	PART-A		
1	Design and Implement a Go program to print the name of the months and number of days based on user input number. Apply switch statement to implement the same.	2	22CDS354.1
2	Implement a calculator program that displays a menu with options 1.Add 2.Sub 3.Mul 4.Div Read2numbersandperformthe relevant operation. After performing the operation, the program should ask the user if he wants to continue. If the user presses y or Y, then the program should continue displaying the menu else the program should terminate.	2	22CDS354.1
3	Accept an array of 5 positive integers. Create a program to find the smallest positive integer in the user input array which cannot be formed from the sum of 2 numbers in the array.	2	22CDS354.1
4	Develop a Go Program to check whether the user given matrix is a sparse or not.		22CDS354.1
5	Design and develop a simple Go function to find the longest substring without repeating characters in a given String.	2	22CDS354.2
6	Illustrate the different types of recursion in Go with suitable programs. Direct, Indirect, Tail and Head Recursion	2	22CDS354.2
	PART-B		
7	Design a structure Employee with name and salary as its filed. Create three employee instances. Print the details and computer the average salary.	2	22CDS354.2
8	Create a program to swap two numbers using pointers in Go.	2	22CDS354.2
9	Apply pointer to structure concept to print the details of 3 student records. Assume Student record to contain USN, name and marks.	2	22CDS354.3
10	Develop a program to illustrate how to create an anonymous Go routine.	2	22CDS354.3
11	Develop a program to illustrate how to start multiple Go routines.	2	22CDS354.4
12	Solve Producer Consumer concurrency issue using Go concurrency concept.	2	22CDS354.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. https://go.dev/solutions/case-studies

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Text Books:

1. Alan A. A Donovan, Brian W. Kernighan, "The Go Programming Language", Addison-Wesley Professional Computing Series ,2016(Reprint)

E-Reference Books:

1. www.tutorialgateway.org/go-programs
2. https://gobyexample.com

BIO INSPIRED DESIGN AND INNOVATION

Course Code	**22BIK36**	**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:

22BIK36.1	Verify the biomimetics principles in relation to the needs at that moment.
22BIK36.2	Evaluate the Bio-material properties for health care applications.
22BIK36.3	Investigate novel bioengineering initiatives by evaluating design and development principles.
22BIK36.4	Investigate creative biobased solutions for socially vital issues with critical thought.
22BIK36.5	Understand the bio computing optimization through research and experiential learning.
22BIK36.6	Explain the fundamental biological ideas through pertinent industrial applications and case studies.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22BIK36.1	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.2	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.3	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.4	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.5	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.6	3	3	3	3	2	-	2	-	1	-	-	2

MODULE-1	**BIO-INSPIRED DESIGN AND ENGINEERING**	**22BIK36.1**	**8 Hours**

Bio-Inspired Engineering and design, History, Evolution, Basics of Bio mimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).

Self-study / Case Study / Applications	Investigate the Challenges of Bio inspired design, Compare with traditional areas of science and engineering.
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**BIO MATERIALS AND BIO HEALTHCARE DESIGN**	**22BIK36.2**	**8 Hours**

Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio-Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko-Inspired Surgical Glue) Robotics, Marine and Aeronautical.

Self-study / Case Study / Applications	Investigate Bio-Compatible alloys and polymers for human implants and health care applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	BIO SUSTAINABLE DEVELOPMENT	22BIK36.3, 22BIK36.4	8 Hours
Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air (purification, filtration), Dew water collection systems, water purification, desalination, Management of spaces, designs for mega structures.			
Self-study / Case Study / Applications	Explore the Bio inspired environmental constructions and development.		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**BIO COMPUTING AND OPTIMISATION**	**22BIK36.5**	**8 Hours**
No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimisation, Ant Colony Optimisation (ACO), Swam Intelligence- Particle Swam Optimisation (PSO).			
Self-study / Case Study / Applications	Scrutinize the Different types of Optimization techniques, genetic research.		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**APPLICATIONS OF BIO-INSPIRED INNOVATIONS**	**22BIK36.6**	**8 Hours**
Bioinspired innovations in– Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).			
Self-study / Case Study / Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same.		
Text Book	Text Book 2: 12.1 to 12.10		

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	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. Helena Hashemi Farzaneh, Udo Lindemann, A Practical Guide to Bio-inspired Design, Springer Vieweg, 1st edition 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830
2. Torben A. Lenau, Akhlesh Lakhtakia, Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology, Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

1. French M, Invention and evolution: Design in Nature and Engineering, Publisher: Cambridge University Press, 2020
2. Pan L., Pang S., Song T. and Gong F. eds, Bio-Inspired Computing: Theories and Applications, 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature, 2021
3. Wann D, Bio Logic: Designing with nature to Protect the Environment, Wiley Publisher, 1994

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc22_ge24/preview
2. https://biodesign.berkeley.edu/bioinspired-design-course/
3. https://www.youtube.com/watch?v=cwxXY9Qe8ss
4. https://www.youtube.com/watch?v=V2GvQXvjhLA
5. https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf

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

- Presenting students with bio-inspired design challenges and asking them to come up with solutions.
- Create physical models or prototypes that mimic biological structures or functions.
- Organizing Group wise discussions on issues
- Seminars

UNIVERSAL HUMAN VALUES AND LIFE SKILLS			
Course Code	**22UHK37**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:

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

22UHK37.1	Understand the concept and significance of life skills and universal human values.
22UHK37.2	Develop Self-awareness and Self-management skills to promote personal growth.
22UHK37.3	Apply Critical and Creative thinking and ethical decision-making skills in various contexts.
22UHK37.4	Promote teamwork and collaboration while respecting diversity and inclusivity.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22UHK37.1	-	-	-	-	-	3	1	3	-	2	-	2
22UHK37.2	-	-	-	-	-	1	2	1	-	2	-	2
22UHK37.3	-	-	-	-	-	3	1	3	1	2	-	2
22UHK37.4	-	-	-	-	-	2	2	1	3	3	-	3

MODULE-1	**Self-Awareness and Self-Management**	**22UHK37.1 22UHK37.2**	**3 Hours**

Emotional Intelligence, Techniques of self-awareness: SWOT and JOHARI WINDOWS, Stress management and coming out of comfort zone, managing failure, Time Management to recalibrate priorities.

Self-Exploration as a process of Value Education, the basic human Aspirations: Prosperity and Happiness, understanding infatuation.

Self-study / Role play	Understand qualities of Role Models, explore self and do SWOT analysis for growth; participate in role play and presentations to come out of comfort zone

MODULE-2	**Towards Yourself**	**22UHK37.1 22UHK37.3**	**3 Hours**

Exploring opportunities, understanding expectations and self for right fitment in profession, Goal Setting - Personal and Professional, aligning Personal and Professional goals for greater achievement, Mind-Maps as a tool for Goal Setting

Self-study / Mind Maps	Understand industry expectations to set professional goals; realizing connection between personal and professional goals for peaceful living

MODULE-3	**Leading self to lead others**	**22UHK37.3 22UHK37.4**	**3 Hours**

Quality analysis of leader and self-evaluation, Critical thinking, Creative thinking and Ethical decision making, Critical thinking and Creative thinking for contribution to technical world, Six thinking hats, Exploring ethical decision-making frameworks and principles.

Activities / Case study/Applications	Case studies for Critical thinking and activities for Creative thinking

MODULE-4	**Ownership towards Family and Society**	**22UHK37.2 22UHK37.3 22UHK37.4**	**3 Hours**

Responsibility, Diversity and Inclusivity: Understanding personal and social responsibility; Appreciating diversity and managing inclusivity, promoting teamwork and collaboration while respecting differences.

Self-study / Interview with corporate people	Working on Task bar; team building activities; Interviewing Corporate experts to understand expectations

MODULE-5	**Towards Nature and Industry**	**22UHK37.3 22UHK37.4**	**3 Hours**

Personal code of conduct for harmony between self and nature, resisting external pressures, negotiation and conflict resolution, assertiveness and empathy, change management

Role play	Role play to understand contributions to nature and industry

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Alternative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	7	6
L3	Apply	8	7
L4	Analyze	10	7
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Group Discussion)

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:

Reference Books:

1. The 7 Habits of Highly Effective People, Stephen R Covey, Neha publishers.
2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.
3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.
4. How to win friends and influence people, Dale Carnegie.
5. BHAGAVADGITA for college students, Sandeepa Gunt reddy.

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

1. Conduct interviews with HR personnel of corporate to understand expectations in terms of Soft Skills and Values
2. Participate in role plays and presentations to come out of comfort zone
3. Talk to industry people to understand opportunities available
4. Make a short movie to display creativity
5. Use Mind maps to plan successful completion of semester
6. Actively participate in Group Discussions and JAM sessions

BASIC APPLIED MATHEMATICS-I
(Common to all Branches)

Course Code	**22DMAT31**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs. / Week	**2**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**--**

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

22DMAT31.1	Know the principles of engineering mathematics through calculus
22DMAT31.2	Determine the power series expansion of a function
22DMAT31.3	Find the definite integrals with standard limits and also develop the ability to solve different types of differential equations
22DMAT31.4	Apply ideas from linear algebra in solving systems of linear equations and determine the Eigen values and Eigen vectors of a matrix

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22DMAT31.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.4	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**DIFFERENTIAL CALCULUS**	**22DMAT31.1 22DMAT31.2**	**8 Hours**

Polar Curves-Problems on angle between the radius vector and tangent, Angle between two curves-Problems, Pedal equation for polar curves-Problems. Maclaurin's theorem for function of one variable (statement only)-Problems.

Text Book	Text Book 1: 4.4, 4.7, 4.8, Text Book 2: 15.4

MODULE-2	**PARTIAL DIFFERENTIATION**	**22DMAT31.1**	**8 Hours**

Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation and NO extended theorem)-Problems, Jacobians of order two - definition and problems.

Text Book	Text Book 1: 5.4, 5.7,

MODULE-3	**INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS**	**22DMAT31.3**	**8 Hours**

Problems on evaluation ofsin n x and cos n x integrals with standard limits (0 to $\pi/2$).Solution of first order and first-degree differential equations-Variable separable, Linear and Exactdifferential equations.

Text Book	Text Book 1: 6.2, 11.6, 11.9, 11.11, Text Book 2: 1.3, 1.4, 1.5

MODULE-4	**LINEAR ALGEBRA-1**	**22DMAT31.4**	**8 Hours**

Problems on rank of a matrix by elementary transformations, Solution of system of linear equations by Gauss elimination method-Problems.

Text Book	Text Book 1: 2.7, 28.6, Text Book 2: 7.3, 7.4

MODULE-5	**LINEAR ALGEBRA-2**	**22DMAT31.4**	**8 Hours**

Linear transformation, Eigen values and Eigen Vectors of square matrix-Problems.

Text Book	Text Book 1: 2.11, 2.13, Text Book 2: 7.9, 8.1.

CIE Assessment Pattern (50 X 2=100 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	-
L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-

Suggested Learning Resources:

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.

Reference Books:

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/IUV0_Nj4d1s?si=eO3s7keCbCO1_jcz
2. https://youtu.be/VzUcs7aiqgg?si=YLtTUGr4Xp88KGY3
3. https://youtu.be/LDBnS4c7YbA?si=udUOdJ-u0ZxFmBAW
4. https://youtu.be/palSdK9P-ns?si=7A8_VSxEI4lGvksB
5. https://youtu.be/Bw5yEqwMjQU?si=jzbklZmVev1w8K2S
6. https://youtu.be/LBqdGn1r_fQ?si=DWcAIiFnosT7zikY
7. https://youtu.be/N5YCGOyTSuU?si=Wsf75V5fkUpfVVxr
8. https://youtu.be/gd1FYn86P0c?si=7drzBEqVFSv6sQeZ
9. https://youtu.be/cSj82GG6MX4?si=4QN1DFXEqaJoUBn7
10. https://youtu.be/0c3yq9btr3A?si=jIoz8eu5TgV7mh8G
11. https://youtu.be/PhfbEr2btGQ?si=HVK1uk65oHph0t8G

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 Algorithms/Flowcharts/Programming Codes
  - Organizing GroupWise discussions on related topics
  - Seminars

DISCRETE MATHEMATICS AND GRAPH THEORY

(Common to AIM, CEE, CSE, CDS, ISE)

Course Code	**22MAC41**	**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:

22MAC41.1	Explain the counting techniques and combinatorics by using the context of discrete probability.
22MAC41.2	Illustrate the principle of Inclusion and Exclusion
22MAC41.3	Apply Pigeon hole principle to solve real life problems.
22MAC41.4	Solve the engineering problems involving relations and functions.
22MAC41.5	Analyze the computer science problems by using graph theory techniques.
22MAC41.6	Justify the arguments with propositional and predicate logic and from truth tables.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MAC41.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAC41.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAC41.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAC41.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAC41.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAC41.6	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**MATHEMATICAL LOGIC**	**22MAC41.1**	**8 Hours**

Basic Connectives and Truth Tables, Tautology and Contradiction, Logic Equivalence, The Laws of Logic, Converse, Inverse and Contra positive, Logical Implication, Rules of Inference.

Case Study	Case studies on roles of logic in specification of computation.
Text Book	Text Book 1: 2.1, 2.2, 2.3.

MODULE-2	**PRINCIPLES OF COUNTING**	**22MAC41.2**	**8 Hours**

Catalan Numbers, Ramsey Numbers, Stirling Numbers and Bell Numbers, The principle of Inclusion and Exclusion, Generalizations of the principle, Derangements, Rook-Polynomials, Arrangements with Forbidden Positions.

Text Book	Text Book 1: 1.5, 8.1, 8.2, 8.3, 8.4, 8.5.

MODULE-3	**RELATIONS AND FUNCTIONS**	**22MAC41.3**	**8 Hours**

Cartesian Products and Relations, One-to-One and onto functions. The Pigeon hole Principle, Function Composition and Inverse Functions. Properties of Relations, Equivalence Relations and Partitions.			
Text Book	Text Book 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 7.4.		
MODULE-4	**GRAPH THEORY**	**22MAC41.4**	**8 Hours**
Graphs-Definitions and examples, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, graph isomorphism, Euler graphs, Hamiltonian paths and cycles.			
Case Study	Case studies on Network Analysis.		
Text Book	Text Book 1: 11.1, 11.2, 11.3, 11.5. Text Book 2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9.		
MODULE-5	**TREES, CONNECTIVITY AND PLANARITY**	**22MAC41.5** **22MAC41.6**	**8 Hours**
Trees, Properties of trees, Rooted and binary trees. Spanning trees, cut sets, Properties of cut set, all cut sets, Fundamental circuits Network flows: Kruskal's algorithm, Planar graphs, Dual of planar graphs, Different representation of a planar graph.			
Case Study	Case studies on Social Network Analysis.		
Text Book	Text Book 1: 11.4, 12.1, 12.2, 12.3, 13.2, Text Book 2: 3.1, 3.5, 3.7, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 5.2, 5.6, 5.7.		

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	-
L3	**Apply**	10	5	10
L4	**Analyze**	2.5	-	-
L5	**Evaluate**	2.5	-	-
L6	**Create**	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	**10**
L3	**Apply**	**20**
L4	**Analyze**	**5**
L5	**Evaluate**	**5**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics-an applied introduction, Pearson Education, Fifth Edition, 2019, ISBN: 9789353433055.
2. Narsingh Deo, Graph Theory with Application to Engineering and Computer Science, Dover Publications Inc., First Edition, 2016, ISBN: 978-0486807935.

Reference Books:

1. Basavaraj S. Anami and Venakanna S. Madalli, Discrete Mathematics – A Concept based approach, Universities Press, 2016, ISBN: 9788173719998.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, McGraw Hill Education**,** Seventh Edition, 2017, ISBN: 9780070681880.
3. D.S. Malik and M.K. Sen, Discrete Mathematical Structures: Theory and Applications, Thomson, 2004. ISBN: 9780619212858.
4. Thomas Koshy, Discrete Mathematics with Applications, Elsevier, First Edition 2005, ISBN: 9788181478870.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/O4Qf0SQKkZw?si=1r9joVe2-rP04fCH
2. https://youtu.be/Hbyj6vEi7fY?si=_GaCjUHBNdV2MArP
3. https://youtu.be/7hLvm_4DNqs?si=viYHH_fZDZQ9Fmdw
4. https://youtu.be/7hLvm_4DNqs?si=viYHH_fZDZQ9Fmdw
5. https://youtu.be/6Z_eengdMVE?si=-ZlPy2xl18oMUwfR
6. https://youtu.be/fwSiTaCs8KM?si=wpZcCEG-pNDuIPkS
7. https://youtu.be/iHC1ZdLdKjw?si=tuN-6pLqhMWPN4Mb
8. https://youtu.be/auvGQCoYdu4?si=3ELSyG5g-475AN1_
9. https://youtu.be/GLHWih_RB38?si=FuoNQAzNR2IlYpU0
10. https://youtu.be/hrumNRQwTV8?si=8o3hB1BbFD-MCNXS
11. https://youtu.be/sWsXBY19o8I?si=ALqpJIlzrAafEVDq

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 Algorithms/Flowcharts/Programming Codes
  - Organizing Groupwise discussions on related topics
  - Seminars

OBJECT ORIENTED PROGRAMMING USING JAVA			
Course Code	**22CDS42**	**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:

22CDS42.1	Understand the real-world entities using Object Oriented Programming concepts.
22CDS42.2	Identify the importance of inheritance and interface concepts and apply to model relationships
22CDS42.3	Analyse the importance of exception handling and string handling operations
22CDS42.4	Apply the concept of Multithreading in concurrent programming
22CDS42.5	Develop applications using collections framework for managing user defined types
22CDS42.6	Solve the real-world problems using Object Oriented concepts and collection framework in Java.

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
22CDS42.1	2	2	2	2	-	-	-	-	-	-	-	2	3	3
22CDS42.2	2	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS42.3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS42.4	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS42.5	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22CDS42.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3

MODULE-1	**INTRODUCTION TO JAVA**	**22CDS42.1**	**8 Hours**

The Java Language, Java Development Kit (JDK); Java Buzzwords, Byte Code, JVM, JRE and Java environment, Data types, variables and Arrays, Operators, Control statement, command line Arguments, Language fundamentals Object Oriented Programming with JAVA: Object Oriented concepts, Classes, Objects and Methods, Method Overloading, Constructor, static members, Implicit this

Self-study	Investigate the concept of "Write Once and Run Everywhere" with suitable Java standalone application on JDK19
Text Book	Text Book 1: Part 1Chapter 1 to 7

MODULE-2	**INHERITANCE AND INTERFACING**	**22CDS42.2**	**8 Hours**

Inheritance, Method Overriding, Access specifiers, Abstract Classes, Final members, The Object Class, Interfaces, Package Fundamentals.

Text Book	Text Book 1: Part 1 Chapter 8,9

MODULE-3	**STRING MANIPULATION**	**22CDS42.3, 22CDS42.4**	**8 Hours**

Constructors, Length Operations, Character Extraction, Comparison, Searching, Modifying, String Buffer, Exception handling: Fundamentals, Types, Using try, catch, throw, throws, finally, User Defined Exceptions.

Text Book	Text Book 1: Part 2 Chapter 15,16 Part 1 Chapter 10

MODULE-4	**Multi-Threading**	**22CDS42.5**	**8 Hours**

Thread Concept, Java Thread Model, The main method, Creating Threads, Thread Priorities, Synchronization, join

Text Book	Text Book 1: Part 1 Chapter 11

MODULE-5	**Collection Framework**	**22CDS42.6**	**8 Hours**

Collections Overview, Collection Interfaces, Set, List, Map, Queue, Collection Classes, Generics, Type Wrappers, Accessing a collection using an Iterator, Sorting collections, equals() and hashCode contract, overriding equals and hashCode methods in Java

Text Book	Text Book 1: Part 1 Chapter 14, Part 2 Chapter 17

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	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	--
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Oracle Press, Tata McGraw Hill,2017 (Reprint)
2. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition , Pearson Education,2018

Reference Books:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OO design usingJava",John Wiley & sons,2019(Reprint).
2. Y. Daniel Liang, "Introduction to JAVA Programming", 10th Edition, PearsonEducation.
3. R. A. Johnson, "Java Programming and Object-Oriented ApplicationDevelopment", Cengage Learning, 2020 (Reprint)

Web links and Video Lectures (e-Resources):

1. JDK 19 Documentation - Home (oracle.com)

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

1. Contents related activities (Activity-based discussions)
   - Hands-on with coding platforms using Java
   - Group wise hackathon in Java language

OBJECT ORIENTED PROGRAMMING USING JAVA LAB			
Course Code	**22CDL42**	**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:

22CDL42.1	Examine the real world applications using Object Oriented Programming concepts.
22CDL42.2	Apply the concept of Multithreading and exception handling in java programming
22CDL42.3	Develop applications using collections framework for managing user defined types
22CDL42.4	Solve the real world problems using Object Oriented concepts and collection framework in Java.

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
22CDL42.1	2	2	2	2	1	-	-	-	-	-	-	2	3	3
22CDL42.2	2	3	3	2	1	-	-	-	-	-	-	2	3	3
22CDL42.3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
22CDL42.4	3	3	3	2	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Hello World program on Eclipse must be run	0.5	NA
	PART-A		
1	Design and Implement a Java program to print the sum of the elements of the array with the given below condition. If the array has 6 and 7 in succeeding orders, ignore 6 and 7 and the numbers between them for the calculation of sum. Eg1) Array Elements - 10,3,6,1,2,7,9 O/P: 22 [i.e. 10+3+9] Eg2) Array Elements - 7,1,2,3,6 O/P:19 Eg3) Array Elements - 1,6,4,7,9 O/P:10	2	22CDL43.1
2	Design and Implement a Java program that displays a menu with options 1. Add 2. Sub Based on the options chosen, read 2 numbers and perform the relevant operation. After performing the operation, the program should ask the user if he wants to continue. If the user presses y or Y, then the program should continue displaying the menu else the program should terminate.	2	22CDL43.1
3	Design and implement an algorithm to accept an array of 5 positive integers. The algorithm must then find the smallest positive integer in the array which cannot be formed from the sum of 2 numbers in the array.	2	22CDL43.1
4	Develop a Java program Write a program to check if the program has received command line arguments or not. If the program has not received the values then print "No Values", else print all the values in a single lines separated by,(comma). Eg1) java Example O/P : No values Eg2)java Example Mumbai Bangalore O/P:Mumbai,Bangalore	2	22CDL43.1

5	Design and develop a simple Java program to find the longest substring without repeating characters in a given String. Accept the String through Command Line argument.	2	22CDL43.2
6	Given a string and a non-empty word string, return a string made of each char just before and just after every appearance of the word in the string. Ignore cases where there is no char before or after the word, and a char may be included twice if it is between two words. •If inputs are "abcXY123XYijk" and "XY", output should be "c13i". •If inputs are "XY123XY" and "XY", output should be "13". If inputs are "XY1XY" and "XY", output should be "11". Create a Java program for the same.	2	22CDL43.2
PART-B			
7	Design a class that can be used by a health care professional to keep track of a patient's vital statistics. Here's what the class should do: • Construct a class called Patient • Store a String name for the patient • Store weight and height for patient as doubles • Construct a new patient using these values Write a method called BMI which returns the patient's BMI as a double. BMI can be calculated as BMI = (Weight in Pounds / (Height in inches x Height in inches)) x 703 Next, construct a class called "Patients" and create a main method. Create a Patient object and assign some height and weight to that object. Display the BMI of that patient.	2	22CDL43.2
8	Create a class in Java called "Calculator" which contains the following: • A static method called powerInt(int num1,int num2) that accepts two integers and returns num1 to the power of num2 (num1 power num2). • A static method called powerDouble(double num1,int num2) that accepts one double and one integer and returns num1 to the power of num2 (num1 power num2). • Call your method from another class without instantiating the class.	2	22CDL43.2
9	Develop a Program to take care of Number Format Exception if user enters values other than integer for calculating average marks of 2 students. The name of the students and marks in 3 subjects are taken from the user while executing the program. • In the same Program write your own Exception classes to take care of Negative values and values out of range (i.e. other than in the range of 0-100) • Include finally to output the statement "Program terminated".	2	22CDL43.3
10	Create class of SalesPersons as a thread that will display fives sales persons name. Create a class as Days as other Thread that has array of seven days. Call the instance of SalesPersons in Days and start both the Threads. Suspend SalesPersons on Sunday and resume on Wednesday.	2	22CDL43.3
11	Create a Student Attendance Management System using a HashMap Collection type. Perform the following operations: Add the key-value pair. Retrieve the value associated with a given key Check whether a particular key/value exist. replace a value associated with a given key in the HashMap	2	22CDL43.4
12	Develop a program to solve the problem given:	2	22CDL43.4

	An array of length N is provided. Count the number of (i,j) pairs where 1<=i<j<=N such that the difference of the array elements on that indices is equal to the sum of the square of their indices. Input : 4, 9, 6, 29, 30 Output: 3 (1,2), (2,4),(1,5) satisfy the above condition		

PART-C

Beyond Syllabus Virtual Lab Content

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

1. [https://java-iitd.vlabs.ac.in/exp/exceptions/] : Handling exceptions in java
2. [https://java-iitd.vlabs.ac.in/exp/life-cycle-thread/]: Life Cycle of a thread

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Oracle Press, Tata McGraw Hill,2017 (Reprint)
2. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition , Pearson Education,2018

Reference Books:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & sons,2019(Reprint).
2. Y. Daniel Liang, "Introduction to JAVA Programming", 10th Edition, Pearson Education.
3. R. A. Johnson, "Java Programming and Object-Oriented Application Development", Cengage Learning, 2017

LOGIC DESIGN AND COMPUTER ORGANIZATION			
Course Code	**22CDS43**	**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:

22CDS43.1	Understand the working of logic Gates and simplify Boolean function using Karnaugh maps.
22CDS43.2	Implementation of combinational logic circuits.
22CDS43.3	Analyze and design of circuits using latch and flipflop's.
22CDS43.4	Design and analyze application of registers and counters.
22CDS43.5	Analyze different methods for computer I/O and functions of Memory System.
22CDS43.6	Develop simple HDL 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
22CDS43.1	2	2	2	2	-	-	-	-	-	-	-	2	2	2
22CDS43.2	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS43.3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS43.4	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS43.5	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS43.6	2	2	2	2	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Digital Logic and Combinational Logic Circuits:**	**22CDS43.1**	**8 Hours**
Introduction to HDL Boolean Laws and Theorems, Sum-of-products Method, Truth Table to Karnaugh Map, Karnaugh Simplifications, Don't Care Conditions, Product-of-sums Method, Product-of-sums Simplification, Simplification by Quine-McClusky Method, Verilog implementation on Combinational Logic Circuits.			
Text Book	Text Book 1: 1.5-1.8,2.1-2.5		
MODULE-2	**Combinational Circuits**	**22CDS43.2**	**8 Hours**
Number System , Base Conversion, Binary Addition, Binary Subtraction, Binary Multiplication and Division, Unsigned Binary Numbers, Sign-Magnitude Numbers, 2's Complement Representation, 2's Complement Arithmetic, Arithmetic Building Blocks			
Text Book	Text Book 3: 4.1- 4.12		
MODULE-3	**Basic Computer Organization and Design**	**22CDS43.3, 22CDS43.4**	**8 Hours**
Instruction Codes, Computer Instruction, Timing and Control, Execution and Instruction, Input-Output and Interrupt, Design of Computer.			
Text Book	Text Book 2- 2.1- 2.6		
MODULE-4	**Central Processor Organization**	**22CDS43.5**	**8 Hours**
Processor Bus Organization, Arithmetic Logic Unit (ALU), Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Microprocessor Organization. Input-Output Organization: Peripheral Devices, Asynchronous Data Transfer, Direct Memory Access (DMA), Priority Interrupt, Input-Output Processor(IOP).			
Text Book	Text Book 2: 4.1 -4.6		
MODULE-5	**Registers and Counters**	**22CDS43**.6	**8 Hours**
Edge-Triggered D Flip Flop, SR Flip Flop, J K Flip Flop, T Flip Flop, Flip Flop with additional inputs, Shift registers, Design of Binary Counters, counters for other sequences using SR and J K Flip Verilog implementation of Flip-flops. Verilog implementation of Registers and counters.			
Text Book	Text Book 1: 8.1 – 8.12		

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	10	5	5
L3	Apply	5	5	5
L4	Analyze	5	-	-
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. Donald P Leach and Albert Paul Malvino, Digital Principles and Applications , 8thEdition, Tata McGraw Hill, 2014.
2. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.
3. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013. 3.

Reference Books:

1. Digital Fundamentals, Thomas Floyd, 11th edition, 2014, Pearson Education
2. An Illustrative Approach to Logic Design, R. D. Sudhakar Samuel, 2010, Pearson Education.
3. Stephen Brown, Zvonko Vranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
4. James W. Bignel, Digital Electronics, Cengage learning, 5th Edition, 2007

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.swayam2.ac.in/nou23_ec05/preview
2. https://www.youtube.com/playlist?list=PLxCzCOWd7aiGmXg4NoX6R31AsC5LeCPHe

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

Practical Based learning : Karnaugh Map Simulator, Synthesis of Flip Flops- Simulator Software

LOGIC DESIGN LAB			
Course Code	**22CDL43**	**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:

22CDL43.1	Analyze and design combinational logic circuits.
22CDL43.2	Realize flip flop and verify the truth table.
22CDL43.3	Implementation of counters using flip flops.
22CDL43.4	Implementation of logic circuits using DLD.

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
22CDL43.1	2	2	2	2	-	-	-	-	-	-	-	2	2	2
22CDL43.2	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDL43.3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDL43.4	3	3	3	3	-	-	-	-	-	-	-	2	2	2

Exp. No. / Pgm. No.	List of Programs	Hours	COs
	PART-A		
1	Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.	2	22CDL43.1
2	Perform half and full adder using combinational circuits.	2	22CDL43.1
3	Perform half and full subtraction using combinational circuits.	2	22CDL43.1
4	Realize JK, D and T Flip-Flops and verify its truth table	2	22CDL43.1
5	Design and implement Ring counter and Johnson counter using 4-bit shift register and demonstrate its working.	2	22CDL43.2
6	Design and implement a mod-n (n<8) synchronous up or down counter using J-K Flip-Flop ICs and demonstrate its working.	2	22CDL43.2
	PART-B		
7	Simulate and verify the working of 8:1 multiplexer using Verilog code.	2	22CDL43.2
8	Simulate and verify the working of half and full adder using Verilog code.	2	22CDL43.2
9	Simulate and verify the working of half and full subtractor using Verilog code.	2	22CDL43.3
10	Simulate and verify the working of the JK,D and T Flip flop using Verilogcode.	2	22CDL43.3
11	Simulate and verify the working of Ring and Johnson Counter using Verilogcode.	2	22CDL43.4
12	Simulate and verify mod 8 synchronous up or down counter using Verilog code.	2	22CDL43.4

PART-C

Beyond Syllabus Virtual Lab Content

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

- Combinational Multipliers [http://vlabs.iitkgp.ernet.in/coa/exp6/index.html]
- Registers and Counters[http://vlabs.iitkgp.ernet.in/coa/exp5/index.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember		
L2	Understand	10	10
L3	Apply	5	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) Joseph Cavanagh, "Verilog HDL Design Examples", Publisher: CRC Press, Taylor & Francis group, 2018, ISBN-9781138099951.

2) Dr. Cherry Bhargava and Dr. Rajkumar Sarma, "Hardware Description Language Demystified: Explore Digital System Design using Verilog HDL and VLSI Design Tools", Publisher: BPB Publications,2020, ISBN- 9789389898040.

3) Charles H Roth and Larry L Kinney, Analog and Digital Electronics, Cengage Learning,2019

OPERATING SYSTEMS			
Course Code	**22CDS44**	**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:

22CDS44.1	Understand the concept of services provided by and the structure of an operating system.
22CDS44.2	Examine the various CPU scheduling algorithms.
22CDS44.3	Implement various operations on deadlock, Analyze various CPU scheduling algorithms.
22CDS44.4	Analyze the efficiency aspect of using system resources and memory management schemes. Handle operations for disk scheduling and file operations
22CDS44.5	Develop various Linux commands that are used to manipulate system operations and file system commands

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
22CDS44.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDS44.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDS44.3	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDS44.4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDS44.5	3	3	3	3	3	-	-	-	-	-	-	2	3	3

MODULE-1	**Operating System**	**22CDS44.1**	**8 Hours**

Concept, Components, Operations, Protection and Security. User view, System View, System Calls: Concept, Types of System Calls. Types of Operating Systems. Process Management: Process Concept, Operation on Processes, Cooperating Processes, Inter-Process Communication, critical section problem, semaphores,
Threads.

Text Book	Text book 1: Chapter 1, 2.1, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4

MODULE-2	**CPU Scheduling**	**22CDS44.2**	**8 Hours**

Basic Concepts, Pre-emptive strategies, Non-pre-emptive strategies, Scheduling Criteria, Scheduling algorithms, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling

Text Book	Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.5, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7

MODULE-3	**Deadlock**	**22CDS44.3**	**8 Hours**

System Models, Deadlock Characterization, Resource Allocation Graph, Deadlock Prevention, Avoidance, Detection and Recovery, Banker's algorithm

Text Book	Text book 1: Chapter 7

MODULE-4	**Memory Management**	**22CDS44.4**	**8 Hours**

Contiguous Memory Allocation, Fragmentation, Paging, And Segmentation. Virtual Memory: Demand Paging, Page Replacement, Page replacement algorithm, Allocation of frames, Thrashing

Text Book	Text book 1: Chapter 8.1 to 8.6

MODULE-5	**File-System Interface**	**22CDS44.5**	**8 Hours**

Concepts, Access Methods, Directory and Disk Structure. File-System Structure **Protection**: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Text Book	Text book 1: Chapter 91. To 9.6, 10.1 to 10.5

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**
L3	**Apply**	5	10	5
L4	**Analyze**	5	-	-
L5	**Evaluate**	-	-	**-**
L6	**Create**	**-**	**5**	**-**

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. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
2. Silberschatz, Galvin, Greg, "Operating System Concepts", Wiley and Sons, 10th Edition, 2018.
3. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Prentice Hall, 2018.

Reference Books:

1. Andrew S Tanenbaum, Albert S Woodhull, "Operating systems design and implementation", 3rd edition.
2. UNIX-Concepts Applications, SUMITABHADAS, McGraw Hill, TATA McGraw HillEdition, 4th edition, 26th reprint 2019
3. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd Edition,Tata McGraw Hill Education,2017

Web links and Video Lectures (e-Resources):

1. https://www.geeksforgeeks.org/what-is-an-operating-system/
2. https://www.javatpoint.com/operating-system
3. https://www.tutorialspoint.com/operating_system/os_overview.htm
4. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/5_CPU_Scheduling.html
5. https://www.scaler.com/topics/operating-system/deadlock-in-os/
6. https://www.guru99.com/deadlock-in-operating-system.html
7. https://onlinecourses.nptel.ac.in/noc21_cs72/preview
8. https://www.udemy.com/course/operating-system-j/

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

1. 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

OPERATING SYSTEMS LAB			
Course Code	**22CDL44**	**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:

22CDL44.1	Demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.
22CDL44.2	Examine the various process scheduling algorithms
22CDL44.3	Implement various operations on deadlock
22CDL44.4	Implement various File Organization, File Allocation Strategies and Disk Scheduling 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
22CDL44.1	3	2	2	2	3	-	-	-	-	-	-	1	3	3
22CDL44.2	3	2	2	2	3	-	-	-	-	-	-	1	3	3
22CDL44.3	3	2	2	2	3	-	-	-	-	-	-	1	3	3
22CDL44.4	3	2	2	2	3	-	-	-	-	-	-	1	3	3

Pgm. No.	List of Programs	Hours	Cos
	Prerequisite Programs		
	• To understand the basics of Unix command and shell programming. • To implement various CPU scheduling algorithms. • To implement Deadlock Avoidance and Deadlock Detection Algorithms • To implement Page Replacement Algorithms • To implement various memory allocation methods. • To be familiar with File Organization and File Allocation Strategies.	2	NA
	PART-A		
1	Introduction- Linux Architecture- Shell, Kernel, System calls. Linux installation- Steps for installing Linux Operating System Internal & External commands in Linux. • Internal commands- echo, type, etc. • External commands- ls, cp, mv, rm, cat, etc • Other commands – tput clear, who, cal, date, bc, man, passwd, uname(with different options). • Expressions & search patterns .(dot operator), *, A, +, ?, grep, egrep, fgrep	2	22CDL44.1
2	Working with files & directories. • Know the categories of files. • Directory related Commands – pwd, mkdir, rmdir, cd, ls • Manipulating Absolute paths and Relative paths using cd command. • File related Commands – cat, cp, mv, rm, comm, cmp, diff, tar, umask, wc Basic File attributes. • Listing seven attributes of a file : ls and its options • File Permissions: Absolute and Relative permissions • Manipulating File permissions using chmod command • Manipulating File Ownership using chown command	2	22CDL44.1

	• Manipulating Hardlink and Softlink using ln command		
3	Process Management commands. • Process creation, status, Identifying process, ps -f &its options, • Running process in background, Job control, and Proces2termination. Changing process priority, scheduling process (Usage of sleep and wait commands)	2	22CDL44.1
4	Design, Develop and Implementation of CPU scheduling by using a. FCFS b. Priority	2	22CDL44.2
5	Design, Develop and Implementation of CPU scheduling by a. SJF b. Round Robin	2	22CDL44.2
6	Design, Develop and Implement Threading and synchronized applications	2	22CDL44.3
	PART-B		
7	Design, Develop and Implement an Algorithm for Dead Lock Detection.	2	22CDL44.3
8	Design, Develop and Implement an Algorithm for Deadlock using Banker's Algorithm.	2	22CDL44.3
9	Design, Develop and Implement a Program by using page replacement algorithms for virtual memory management	2	22CDL44.3
10	Design, Develop and Implement the various File Organization Techniques	2	22CDL44.4
11	Design, Develop and Implement the following File Allocation Strategies a. Sequential b. Indexed c. Linked	2	22CDL44.4
12	Design, Develop and Implement various disk scheduling algorithms	2	22CDL44.4

PART-C

Beyond Syllabus Virtual Lab Content

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

- Dead lock, Scheduling https://naim30.github.io/OS-virtual-lab/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	-	-
L3	**Apply**	10	15
L4	**Analyze**	5	10
L5	**Evaluate**	5	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
2. Silber schatz, Galvin, Greg, "Operating System Concepts", Wiley and Sons, 10th Edition, 2018.
3. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Prentice Hall, 2018.
4. Andrew S Tanenbaum, Albert S Woodhull, "Operating systems design and implementation", 3rd edition.
5. UNIX-Concepts Applications, SUMITABHADAS, McGraw Hill, TATA McGraw HillEdition, 4th edition, 26th reprint 2019.
6. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", 3rd Edition, Tata McGraw Hill Education,2017

IoT PROGRAMMING			
Course Code	**22CDS451**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

22CDS451.1	Implement IoT concepts, underlying technologies and migration of M2M to IoT.
22CDS451.2	Deploy the M2M fundamentals and data management
22CDS451.3	Analyze the various features of IoT standard protocols and platforms
22CDS451.4	Implement programs using Raspberry pi model
22CDS451.5	Understand the interface concepts with networks
22CDS451.6	Design and Develop real world IoT application using system like Raspberry pi.

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
22CDS451.1	3	3	2	2	3	-	-	-	-	-	-	2	3	3
22CDS451.2	3	2	2	2	3	-	-	-	-	-	-	1	3	2
22CDS451.3	2	3	2	2	3	-	-	-	-	-	-	2	2	3
22CDS451.4	3	2	2	2	2	-	-	-	-	-	-	1	3	2
22CDS451.5	2	3	2	2	3	-	-	-	-	-	-	2	2	3
22CDS451.6	3	3	2	2	2	-	-	-	-	-	-	2	3	3

MODULE-1	**Introduction to IoT**	**22CDS451.1**	**8 Hours**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack - Fog, Edge and Cloud in IoT, -IoT and Digitization – Convergence of IT and IoT – IoT Challenges

Laboratory Component: **(Experiments)**

1. Introduction to Arduino platform and its installation. Familiarization with Arduino set up with "Hello World" Program.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface TCS3200 Color Sensor with Arduino to detect the colors and display them on serial monitor.

Text Book	Text Book 1: 1.1,1.3,1.4,2.3,2.5

MODULE-2	**M2M and IoT Technology Fundamentals**	**22CDS451.2**	**8 Hours**

Devices and gateways, Actuators and its types, Data management, Connecting Smart Objects, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

Laboratory Component: **(Experiments)**

1. To interface Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED at sensor detection.
2. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
3. To interface smoke sensor with Arduino/Raspberry Pi and write a program to turn on alarm when smoke is detected.

Text Book	Text Book 1: 3.3,3.4,3.8,4.2,4.5,4.7

MODULE-3	**IoT Protocols and Platforms**	**22CDS451.3**	**8 Hours**

6LowPAN,Wi-fi,Bluetooth, COAP, MQTT, Zigbee Architecture, LoRaWAN Platforms: Components of Microsoft Azure, Google cloud

Laboratory Component: (Experiments)

1. Demonstrate the connectivity of Arduino/Raspberry Pi with PIR motion sensor with an application to detect obstacle and notify user using LED/LCD.
2. To interface ultrasonic sensor with Arduino/Raspberry Pi and write a program to display the distance of the obstacle.

Text Book	Text Book 1: 6.1, 6.2.3,6.4,7.2,7.4,7.5,7.7,7.8

MODULE-4	IoT Programming	22CDS451.4	8 Hours

Introduction to Raspberry PI, Rasbian OS, interfacing analog and digital devices, enabling network connectivity ,Connecting with web Server, API Connectivity: Open Weather map API

Laboratory Component: **(Experiments)**

1. To interface float sensor to detect water level in over head tanks and warn the overflow using Arduino/Raspberry PI with an LED
2. To interface ADXL335 accelerometer with Arduino/Raspberry Pi to detect the various orientation and display it on serial monitor.

Text Book	Text Book 1:9.2,9.3,9.4,9.5,10.4,11.3,11.4,11.5,12.3

MODULE-5	Applications of IoT	22CDS451.5, 22CDS451.6	8 Hours

Use of Big Data and Visualization in IoT - Industry 4.0 concepts , Web Enabled Constrained Devices, Role of Machine Learning, Monitoring ambient room temperature using DHT11 Sensor, Using an RPi to Control an RGB LED

Laboratory Component: **(Experiments)**

1. Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, Green On, White On)for each hand movement (use Ultra sonic sensor).
2. To interface soil moisture sensor to display the quality of soil moisture values using Arduino.

Text Book	Text Book 1: 15.2,15.4,15.5,16.2,16.3

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	2	-
L3	Apply	5	3	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. Maciej Kranz,"Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry", 1st Edition,Wiley,2021
2. David Hanes , Gonzalo Salgueiro , Patrick Grossetete, Robert Barton (Author), Jerome Henry," IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things "1st Edition,Cisco Press,2021
3. Colin Dow, "Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python", 1st edition, Packt Publishing,2018
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", First Edition, Cisco Press, 2017

REFERENCE BOOKS

1. Qinghao Tang (Author), Fan Du," Internet of Things Security: Principles and Practice", 1st edition,Springer,2021
2. Chandrasekar Vuppalapati, "Building Enterprise IoT Applications", 1st Edition, Academic Press, 2019.

3. Peter Waher, “Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3”, First Edition, Packt Publishing, 2018

Web links and Video Lectures (e-Resources):

1. "Raspberrypi", https://www.raspberrypi.org/
2. IoTprotocols, https://www.postscapes.com/internet-of-things-protocols/
3. IoTPlatforms, https://www.javatpoint.com/iot-tutorial

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

Project based Learning

R PROGRAMMING FOR DATA SCIENCE

Course Code	**22CDS452**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CDS452.1	Implement the fundamental concepts of R programming.
22CDS452.2	Apply the use of data structure and loop functions
22CDS452.3	Analyze the Matrix and Arrays Concepts
22CDS452.4	Examine Lists and Data Frames in R.
22CDS452.5	Examine the built in and user defined functions in R Programming.
22CDS452.6	Implement Visualizing and Analyzing Data in R Programming.

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
22CDS452.1	2	1	2	2	3	-	-	-	-	-	-	2	2	2
22CDS452.2	2	1	2	-	-	-	-	-	-	-	-	2	2	2
22CDS452.3	2	1	2	2	3	-	-	-	-	-	-	2	2	2
22CDS452.4	2	1	2		3	-	-	-	-	-	-	2	2	2
22CDS452.5	2	1	2	2	3	-	-	-	-	-	-	2	2	2
22CDS452.6	2	1	2	-	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Introduction to R programming**	20CDS452.1, 20CDS452.2	**8 Hours**

Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

Laboratory Component: (programs)

1. Study of data analysis using MS-Excel(Prerequisite)
2. Demonstrate Installing R and RStudio
3. Demonstrate working in the Console Arithmetic Operators.

MODULE-2	**Matrices and Arrays**	20CDS452.3	**8 Hours**

Matrices and Arrays: Defining a Matrix, Sub-setting, Matrix Operations, Conditions and Looping: if statements, looping with for, looping with while, vector based programming.

Laboratory Component:(programs)

1. Implementation of vector and List data objects operations
2. Implementation of various operations on matrix, array and factors in R
3. Study and implementation of various control structures in R

MODULE-3	**Lists and Data Frames**	20CDS452.4	**8 Hours**

Lists and Data Frames: Data Frames, Lists, Special values, The apply family.

Laboratory Component: (programs)

1. To Create Sample (Dummy) Data in R and perform data manipulation with R.
2. Implementation and perform the various operations on data frames in R
3. Data Manipulation with dplyr package

MODULE-4	**Functions**	20CDS452.5	**8 Hours**

Functions: Calling functions, scoping, Arguments matching, writing functions: The function command, Arguments, specialized function.

Laboratory Component: (programs)

1. Demonstrate the User defined Functions in R.
2. Data Manipulation with data. table package
3. Study and implementation of data transpose operations in R

MODULE-5	**Pointers & Data Visualization**	20CDS452.6	**8 Hours**

Pointers: packages, frames, de bugging, manipulation of code, compilation of the code.

Laboratory Component: (programs)

1. Implement Histograms, Scatter plots, Box plot in R.
2. Study and implementation of Data Visualization with ggplot2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**		
		Test (s)	**Qualitative Assessment**	**Lab**
		25	**05**	**20**
L1	**Remember**	5	-	-
L2	**Understand**	5	2	-
L3	**Apply**	5	3	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:

Textbooks

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

References

1. Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015

Web links and Video Lectures (e-Resources):

1. Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free at http://r4ds.had.co.nz

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

Demonstration of simple projects

PROGRAMMING FOR UI AND UX DESIGN			
Course Code	**22CDS453**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CDS453.1	Ability to understand the goals of user interface design.
22CDS453.2	Implement the design processes and development methodologies in UI.
22CDS453.3	Design application with the Knowledge on Menus, Form Filling, Dialog boxes.
22CDS453.4	Implement user interaction with interfaces and designing intuitive interactions.
22CDS453.5	Conducting tests to evaluate the usability and effectiveness of designs.
22CDS453.6	Working effectively in multidisciplinary teams and communicating design decisions.

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
22CDS453.1	3	2	3	2	3	-	-	-	-	-	-	2	3	2
22CDS453.2	3	2	3	2	3	-	-	-	-	-	-	2	3	2
22CDS453.3	3	2	3	2	3	-	-	-	-	-	-	2	3	2
22CDS453.4	3	2	3	2	3	-	-	-	-	-	-	2	3	2
22CDS453.5	3	2	3	2	3	-	-	-	-	-	-	2	3	2
22CDS453.6	3	2	3	2	3	-	-	-	-	-	-	2	3	2

MODULE-1	**USER INTERFACE DESIGN**	**22CDS453.1**	**8 Hours**

Introduction, Goals of user interface design, Motivations for human factors in design, Object-Action Interface model, The Eight Golden rules of Interface design.

Laboratory Component:

1. Organize the steps to get started with UI designing tool Figma.
2. Create a design system with linked UI components in Figma.
3. Create a project in Figma.

Text Book	Text Book 1: 1.1,1.3,1.4,2.3,2.5

MODULE-2	**DESIGN PROCESSES**	**22CDS453.2**	**8 Hours**

The Three Pillars of design, Development methodologies, and Social impact statement for early design review, Expert Reviews, Acceptance Tests and Controlled Psychologically Oriented Experiments.

Laboratory Component:

1. Create a project for UI and UX design using wonder share Mockitt tool.
2. Add UX design Widgets.
3. Create and preview interactions for UX design.

Text Book	Text Book 1: 3.3,3.4,3.8,4.2,4.5,4.7

MODULE-3	**DIRECT MANIPULATION AND VIRTUAL ENVIRONMENT**	**22CDS453.3**	**8 Hours**

Direct Manipulation systems, Spatial data management, Visual Thinking, Task related organization, Response time and display rate, Fast movement through MENUS, Form Fillin, and Dialog Boxes.

Laboratory Component:

3. Build a navigation menu with components in Figma.
4. Designing and prototyping forms in Figma.
5. Create a dialog box in Figma.

Text Book	Text Book 1: 6.1, 6.2.3,6.4,7.2,7.4,7.5,7.7,7.8

MODULE-4	**INTERACTION DEVICES**	**22CDS453.4**	**8 Hours**

Keyboards and Function Keys, Pointing Devices, Speech Recognition, Image and video displays, User Productivity, Non anthropomorphic design, Display Design, Color, Preparation of printed manuals.

Laboratory Component:

1. Create connections and flows in Figma
2. Implementation of Interactive design and functional layout.
3. Create a working UI/UX prototype using prototyping tools.

Text Book	Text Book 1:9.2,9.3,9.4,9.5,10.4,11.3,11.4,11.5,12.3		
MODULE-5	**VISUALIZATION**	**22CDS453.5, 22CDS453.6**	**8 Hours**

Database query and phrase search, Information visualization, Advanced filtering, Hypertext and Hypermedia, World wide web.

Laboratory Component:

1. Data Visualization design tool for UI/UX Designers.
2. Add links to text.
3. Web and UI design using Figma and Webflow.

Text Book	Text Book 1: 15.2,15.4,15.5,16.2,16.3

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		**Marks Distribution**		
		Test (s)	**Qualitative Assessment**	**Lab**
		25	**05**	**20**
L1	**Remember**	5	-	-
L2	**Understand**	5	2	-
L3	**Apply**	5	3	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) Designing the user interface strategies for effective Human-Computer Interaction, Third Edition by Ben Shneiderman.

REFERNCE BOOKS:

1) The Essential Guide to User Interface Design - d Edition: An Introduction to GUI Design Principle s and Techniques Paperback – Import, 17 April 2007by WO Galitz.

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. https://www.udemy.com/course/ui-ux-web-design-using-adobe-xd/
3. https://www.coursera.org/specializations/user-interface-design
4. https://www.figma.com/

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

1.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

C# & .NET			
Course Code	**22CDS454**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

22CDS454.1	Understand the technologies of the .NET framework
22CDS454.2	Understand the basic and object oriented concepts in C#.
22CDS454.3	Model the real world entities as classes and objects using C# object oriented Programming concepts.
22CDS454.4	Apply exception handling and gain efficient testing, debugging skillsC#.
22CDS454.5	Applying interfaces and Events in C# programming.
22ICDS454.6	Develop Windows applications based on C# programming libraries and .NET Framework.

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
22CDS454.1	2	2	2	2	2	-	-	-	-	-	-	2	2	2
22CDS454.2	2	2	2	2	2	-	-	-	-	-	-	2	2	2
22CDS454.3	2	2	2	2	2	-	-	-	-	-	-	2	2	2
22CDS454.4	2	2	2	2	2	-	-	-	-	-	-	2	2	2
22CDS454.5	2	2	2	2	2	-	-	-	-	-	-	2	2	2
22ICDS454.6	2	2	2	2	2	-	-	-	-	-	-	2	2	2

MODULE-1	**INTRODUCTION TO .NET**	22CDS454.1	**8 Hours**

TheC#Environment:.NETFramework–AnOverview,Componentsof.NET,CommonLanguageSpecification(CLS),CommonLanguageRuntime(CLR),Microsoft Intermediate Language ("MSIL" or "IL"),The Common Type System(CTS), .NET Framework Base Classes, Object-Oriented Programming concepts: Encapsulation, Polymorphism, Inheritance, The .Net Languages.

List of Programs:

1) Download and install first visual studio.
2) Creating First Console application.
3) Write a C# Sharp program to swap two numbers.

Text Book	Text Book 1: 1.2,1.3,1.4.1,2.1, Text Book 2:7.2

MODULE-2	**AN OVERVIEW OF C#**	22CDS454.2, 22CDS454.3	**8 Hours**

C# Program –Execution, Sample Programs, Command Line Arguments, Programming Examples, Literals, Variables and Data Types: Keywords, Identifiers, Literals, Variables, Data Types, Boxing and Unboxing. operators, branching and looping.

List of Programs:

1) Develop C# program to show command line arguments.
2) Demonstrate boxing and unboxing.
3) Develop C# console application with looping and branching logics.

Text Book	Text Book 1: chapter 2.2,3.1- 3.8,4.1-4.3,5.1-5.9 & 11.11

MODULE-3	STRUCTURES AND ENUMERATIONS	22CDS454.3	8 Hours

Structures-Defining a Structure, Assigning Values to Members ,Structures with Methods, Nested Structures, Classes Vs Structures, Guidelines to use Structures; Enumerations-Enumerator Initialization, Enumerator Base Types, Enumerator Type Conversion. Classes and Objects: Classes, Constructors & Destructors, Nesting of Classes, Members, Properties.

List of Programs:

1) Develop c# application using classes and object to display student data by using
   a)Ordinary method.
   b)Constructors.
2) Develop static classes and show how to display current salary and upraised salary using static methods
3) C# program to illustrate Nesting of structures.

Text Book	Text Book 1: 6.1-6.2,6.4-6.5,10.2,12.10-12.13

MODULE-4	EXCEPTION HANDLING	22CDS454.4	8 Hours

Exceptions – An Overview, Exception Handling Syntax, Multiple Catch Statements, The Exception Hierarchy, General Catch Handler, Using 'Finally', Nested Try Blocks, User Defined Exceptions, Checked and Unchecked.

List of Programs:

1. Demonstrate c# program to handle error using try catch.
2. Demonstrate user Defined exception in c#.
3. Demonstrate Checked and unchecked in C#.

Text Book	Text Book 1: 13.1-13.13

MODULE-5	INTERFACES AND DELEGATES	22CDS454.5, 22CDS454.6	8 Hours

Defining Interfaces, Extending Interfaces, Implementing Interfaces, Explicit Interface Implementation, Abstract Classes and Interfaces, Delegates, Multicast Delegates,. Developing Windows Applications

List of Programs:

1. Demonstrate usage of delegates.
2. Demonstrate interface concept c
3. Develop a small Windows based application

Text Book	Text Book 2: 6.2-6.4

CIE Assessment Pattern(50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	2	-
L3	Apply	5	3	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**	20
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1. HerbertSchildt,"TheCompleteReference:C#4.0",TataMcGraw Hill, 2012.2.ChristianNageletal."Professional C#2012with.NET4.5",Wiley India,2012.
2. Mark J. Price," C# 8.0 and .NET Core 3.0" – Modern Cross-Platform Development, Fourth Edition, Expert Insight, 2019.

Reference Books:

1. Andrew Troelsen, "ProC#2010andthe.NET 4Platform,Fifth edition, A Press,2010.
2. Ian Griffiths, Matthew Adams,JesseLiberty,"ProgrammingC#4.0",Sixth Edition,O"Reilly, 2010.

Web links and Video Lectures (e-Resources):

1. https://ict.iitk.ac.in/courses/introduction-to-c-sharp/
2. https://dotnet.microsoft.com/en-us/languages/csharp
3. https://www.udemy.com/course/c-net-core-for-beginnershttps://www.youtube.com/watch?v=SXmVym6L8dw&list=PLAC325451207E3105

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

Demonstration of visual studio

Video demonstration of window application

Contents related activities (Activity-based discussions)

- For active participation of students, instruct the students to work in batches
- Organizing Group wise discussions on programs
- Seminars

DATA VISUALIZATION USING TABLEAU			
Course Code	**22CDS461**	**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:

22CDS461.1	Implement & describe the main concepts of data visualization
22CDS461.2	Apply the main chart types and their recommended usage
22CDS461.3	Deploy the most important visual best practices
22CDS461.4	Create charts and dashboards using Tableau

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
22CDS461.1	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS461.2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS461.3	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS461.4	2	2	2	2	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Demo		
	Data Visualization , Analyzing Charts to derive insights	2	NA
	PART-A		
1	Introduction to data visualization	2	22CDS461.1
2	First steps in Tableau	2	22CDS461.1
3	Design required modules	2	22CDS461.2
4	Creating core chart visuals in Tableau	2	22CDS461.2
5	Visual best practices	2	22CDS4613
6	Filtering and sorting data in Tableau	2	22CDS461.3
	PART-B		
7	Formatting charts and visuals in Tableau	2	22CDS461.3
8	Interactive data visualizations	2	22CDS461.3
9	Working with multiple charts in a dashboard	2	22CDS461.3
10	Working with geospatial data and maps	2	22CDS461.3
11	Intro to data storytelling & Creating data stories in Tableau	2	22CDS461.4
12	Personal project	2	22CDS461.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://www.iiitmk.ac.in/DAVirtalLab/Register.php**

CIE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

1. "Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few **Website:** Perceptual Edge
2. "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky". **Website:** O'Reilly Media

References

1. https://www.tableau.com/learn/training

ETHICAL HACKING PRACTICES			
Course Code	**22CDS462**	**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:

22CDS462.1	Understand the basics of computer based vulnerabilities.
22CDS462.2	Analyze the different foot printing, reconnaissance and scanning methods.
22CDS462.3	Apply the various hacking options available in Web and wireless applications and explore the options for network protection
22CDS462.4	Evaluate the enumeration and vulnerability analysis methods.

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
22CDS462.1	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS462.2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS462.3	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS462.4	2	2	2	2	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Introduction	2	NA
	PART-A		
1	Install Kali or Backtrack Linux / Meta sploitable/ Windows XP	2	22CDS462.1
2	Practice the basics of reconnaissance.	2	22CDS462.2
3	. Using FOCA / Search Diggity tools, extract metadata and expanding the target list.	2	22CDS462.2
4	Aggregates information from public databases using online free tools like Paterva's Maltego.	2	22CDS462.2
5	Information gathering using tools like Robtex.	2	22CDS462.2
6	Scan the target using tools like Nessus.	2	22CDS462.2
	PART-B		
7	View and capture network traffic using Wireshark.	2	22CDS462.3
8	Automate dig for vulnerabilities and match exploits using Armitage	2	22CDS462.3
9	Web Server, SQL Injection, Cross Site Scripting	2	22CDS462.3
10	Exploit Writing, Buffer Overflow	2	22CDS462.3
11	Incident Handling & Response	2	22CDS462.4
12	Bluetooth Hacking, Mobiles Phone Hacking.	2	22CDS462.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://www.hackthebox.com/hacker/hacking-labs**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	10
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:

References

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.
4. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

CLOUD-BASED COLLABORATIVE WORKSPACE			
Course Code	**22CDS463**	**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:

22CDS463.1	Demonstrate the access and setting of google account creation and management
22CDS463.2	Demonstrate the collaboration tools such as Classroom, Docs, Sheets, Slides, Forms and Drive
22CDS463.3	Create a Virtual Machine using Oracle Virtual Box and test the communication between the guest OS and Host OS using the PING command
22CDS463.4	Build an application in various cloud platforms and integrate it with a local IDE to launch that application

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
22CDS463.1	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS463.2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS463.3	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS463.4	2	2	2	2	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Demos		
	1. Cloud Storage **2. Various Cloud Collaborative tools**	2	NA
	PART-A		
1	a) Create a Test domain for demonstrating Sign-Up, Sign-in and Profile Setting using Google Workspace. b) Demonstrating the Basic and Advance calendar settings that's includes the integrating, Sharing and Updating Using Google Calendar.	2	22CDS463.1
2	Demonstrating the following feature using Google Docs a) Get started with Google Docs b) Open and Create a new doc c) Collaboration Docs in the Cloud d) Version history Google Docs e) Simple Editing Options f) Google Docs Addons g) Advanced Editing Option -Word Count Tracker h) Document Formatter and Translation Assistant	2	22CDS463.2
3	Demonstrating the following feature using Google Sheets a) Get started with Google Docs b) Open and Create a new Sheet c) Basic Editing Option in Google Sheets d) Basic Formulas in Google Sheets e) Advanced Editing Option	2	22CDS463.2
4	Demonstrating the following feature using Google Slides a) Create Google Slides b) Adding Content to Slides and Insert More Content Options c) Customize Buttons and Options d) Slides Share and collaborate e) Format Options Slides f) Slides View Options and Slide Transitions	2	22CDS463.2

5	Demonstrating the following feature using Google form a) Sections, Previewing, Linear Scale, Multiple Choice Grid, DOB, Moving Questions b) Go to section based on Answer c) Upload Files into a Google Form d) Designs for your Forms e) Adding Images and Videos & Importing Questions f) Getting Responses g) Google Forms Addons	2	22CDS463.2
6	Demonstrating the following feature using Google Site a) Create Update Layout of Page b) Change your Sites Theme and Style c) Add Pages to Sites d) Google Sites Navigation e) Edit and Update f) Announcement banner g) Site Sharing and Collaboration h) Google Sites Launch	2	22CDS463.2
	PART-B		
7	Demonstrating the following feature using Google Drive a) Organise your Google Drive b) Managing Workspaces c) Uploading Files and Folders d) Search and Cloud Search e) Google Drive for Desktop f) Collaboration with Google Drive g) Shared Drives	2	22CDS463.3
8	Install Oracle Virtual box and create two VMs on your laptop/Desktop.	2	22CDS463.3
9	Use version control systems to create a central repository and local repository.	2	22CDS463.3
10	Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.	2	22CDS463.3
11	Develop a Hello World application using Google AppEngine in Eclipse.	2	22CDS463.4
12	Create a hello world app and other simple web applications using python / java. Use GAE launcher to launch the web applications.	2	22CDS463.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://www.rwu.edu/who-we-are/administrative-offices/information-technology/virtual-labs**

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	10
L5	**Evaluate**	**5**	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1. "Effect of Using Google Workspace in Self-Regulated English Learning of Flipped Classroom." PhD diss., 2022.
2. Thuan, P. D. (2022). Employment of Google Tools in English Language Education: A Review. *British Journal of Multidisciplinary and Advanced Studies*, *3*(2), 70-77.
3. Sunyaev, A., & Schneider, S. (2013). Cloud services certification. *Communications of the ACM*, *56*(2), 33-36.

FILE STRUCTURES			
Course Code	**22CDS464**	**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:

22CDS464.1	Implement operations related to files
22CDS464.2	Apply the concepts of file system to produce the given application
22CDS464.3	Evaluate performance of various file systems on given parameters.
22CDS464.4	Demonstration on minimizing seek time

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
22CDS464.1	2	3	2	2	2	-	-	-	-	-	-	2	3	-
22CDS464.2	2	3	2	2	2	-	-	-	-	-	-	2	3	-
22CDS464.3	2	3	2	2	2	-	-	-	-	-	-	2	2	-
22CDS464.4	2	3	2	2	2	-	-	-	-	-	-	2	3	-

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	1. Basic File handling operation(eg: fopen, fclose etc.) 2. File location **3.** File creation and opening modes	2	NA
	PART-A		
1	Write a program to read series of names, one per line, from standard input and write these names spelled in reverse order to the standard output using I/O redirection and pipes	2	22CDS464.1
2	Write a program to read series of names, one per line, using an input file specified by the user instead of the standard input and using an output file specified by the user instead of the standard output.	2	22ISE464.1
3	Write a program to read and write student objects with fixed-length records and the fields delimited by "|". Implement pack ( ), unpack ( )	2	22ISE464.2
4	Write a program to read and write student objects with fixed-length records and the fields delimited by "|". Implement modify ( ) and search ( ) methods.	2	22ISE464.2
5	Write a program to read and write student objects with Variable - Length records using any suitable record structure. Implement pack ( ), unpack ( )	2	22ISE464.2
6	Write a program to read and write student objects with Variable - Length records using any suitable record structure. Implement modify ( ) and search ( ) methods	2	22ISE464.2
	PART-B		
7	Write a program to write student objects with Variable - Length records using any suitable record structure and to read from this file a student record using RRN.	2	22ISE464.3
8	Write a program to implement simple index on primary key for a file of student objects. Implement add ( ), search ( ), delete ( ) using the index.	2	22ISE464.3

9	Write a program to read two lists of names and then match the names in the two lists using Consequential Match based on a single loop. Output the names common to both the lists.	2	22ISE464.3
10	Write a program to read k Lists of names and merge them using k-way merge algorithm with k = 8.	2	22ISE464.4
11	Write a program to store and retrieve student data from file using hashing.	2	22ISE464.4
12	Write a program to store and retrieve student data from file using extended hashing.	2	22ISE464.4

PART-C

Beyond Syllabus Virtual Lab Content

1. https://mitcommlab.mit.edu/be/commkit/file-structure/
2. https://visualgo.net/en

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	10
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) File Structures: An Object-Oriented Approach with C++: United States Editionby Michael J. Folk (Author), Bill Zoellick (Author), Greg Riccardi (Author)

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	**22SCK47**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**--**
Hrs / Week	**02**	**Total Marks**	**50**
Credits	**01**	**Exam Hours**	**02**

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

22SCK47.1	Communicate and connect to the surrounding
22SCK472	Understand the needs and problems of the community and involve them in problem –solving
22SCK47.3	Develop among themselves a sense of social & civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems
22SCK47.4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22SCK47.1	-	-	-	-	-	3	2	-	2	3	-	1
22SCK472	-	-	-	-	-	3	2	-	2	3	-	1
22SCK47.3	-	-	-	-	-	3	2	-	2	3	-	1
22SCK47.4	-	-	-	-	-	3	2	-	2	3	-	1

MODULE-1	**PLANTATION AND ADOPTION OF A TREE**	**22SCK47.1, 22SCK47.2**	**3 Hours**

Plantation of a tree that will be adopted for three years by a group of B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

MODULE-2	**HERITAGE WALK AND CRAFTS CORNER**	**22SCK47.2, 22SCK47.3**	**3 Hours**

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms- Objectives, Visit, case study, report, outcomes.

MODULE-3	**ORGANIC FARMING AND WASTE MANAGEMENT**	**22SCK47.4, 22SCK47.4**	**3 Hours**

Usefulness of organic farming, wet waste management in neighbouring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.

MODULE-4	**WATER CONSERVATION**	**22SCK47.3, 22SCK47.4**	**3 Hours**

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

MODULE-5	**FOOD WALK**	**22SCK47.1, 22SCK47.4**	**3 Hours**

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

CIE Assessment Pattern (50 Marks – Activity based) –

- **Each module is evaluated as given below and 100 marks in scaled down to 50 as final marks.**

CIE component for each module	Marks
Field Visit, Plan, Discussion	10
Commencement of activities and its progress	20
Case study-based Assessment Individual performance with report	20
Modulewisestudy&itsconsolidation5*5 =25	25
Video based seminar for 10 minutes by each student at the end of semester with report. Activities1 to 5, 5*5 =25	25
Total	**100**

- Implementation strategies of the project (NSS work).
- Individual student has to submit a final report which should be signed by NSS Officer, the HOD and Principal.
- Finally, the consolidated marks sheet and the reports should be available in the department. .

Activity-Based Learning / Practical Based learning

- Platform to connect to others and share the stories with others:
  - Jamming session
  - Open mic
  - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-actplay, art-painting, and fine art.

Pedagogy:

- The students will be divided into groups. Each group will be handled by faculty mentor.
- A total of 40 - 50 hrs engagement in the semester
- Faculty mentor will design the activities (particularly Jamming sessions, open micand poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.
- There should be positive progress in the vertical order for the benefit of society in general though activities.

Plan of Action:

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
  - Lecture session in field to start activities
  - Students Presentation on Ideas
  - Commencement of activity and its progress
  - 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.

SNo	Topic	Group size	Location	Activity execution	Reporting	Evaluation of the Topic
1.	**Plantation and adoption of a tree**	May be individual or team (3-5)	Farmers land/ parks /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
2.	**Heritage walk and crafts corner**	May be individual or team (3-5)	Temples / monumental places / 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	Evaluation as per the rubrics of scheme and syllabus

					authority	
3.	**Organic farming and waste management**	May be individual or team (3-5)	Farmers land/parks/Villages visits /roadside/community area / 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
4.	**Water conservation:** Conservation techniques	May be individual or team (3-5)	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
5.	**Food walk:** Practices in society	May be individual or team (3-5)	Villages/CityAreas/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

MINI PROJECT			
Course Code	**22CDS48**	**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:

22CDS48.1	Apply the knowledge of appropriate domains of the Solve real world problems
22CDS48.2	Design modules for solving the problems identified
22CDS48.3	Implement modules with a suitable software framework
22CDS48.4	Analyze real world problems through survey of existing 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
22CDS48.1	3	3	3	2	3	1	2	1	1	1	3	2	3	3
22CDS48.2	3	3	3	2	3	1	2	1	1	1	3	2	3	3
22CDS48.3	3	3	3	2	3	1	2	1	1	1	3	2	3	3
22CDS48.4	3	3	3	2	3	1	2	1	1	1	3	2	3	3

The student shall be capable of identifying a problem related to the field of Computer Science and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The work progress towards the project will be reviewed by a panel of experts during the course of the semester. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

Scope of the Mini project areas, but are not limited to :

1) Data Structure driven applications
2) DBMS
3) Web Design Technologies
4) Data Analytics
5) Java Based Projects
6) Digital Design Hardware
7) Operating Systems

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	10
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	-
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	10

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:

22NSSX0.1	Understand the importance of his / her responsibilities towards society.
22NSSX0.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSSX0.3	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.
22NSSX0.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony ingeneral.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22NSSX0.1	-	-	-	-	-	3	-	-	2	-	-	1
22NSSX0.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.4	-	-	-	-	-	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 for implementation. **6.** Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/vocational education.	22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4	30 HRS
5TH 22NSS50	**7.** Developing Sustainable Water management system for rural areas and implementation approaches. **8.** Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atma nirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. **9.** Spreading public awareness under rural out reach programs. (minimum5programs).	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS
6TH 22NSS60	**10.** Organize National integration and social harmony events/ workshops/ seminars.(MinimumTWO 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 Selectionoftopic,PHASE-1	10
Commencement of activit and its progress-PHASE-2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Videobasedseminarfor10minutesbyeach 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.
- Atlast 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. Studentsshouldhavededicationtoworkatanyremoteplace,anytimewithavailable 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.
- Encouragethestudentsforgroupworktoimprovetheircreativeandanalyticalskills.

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 10minutes by each student at the end of semester with Report.

SlNo	Topic	Group size	Location		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 asper the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/CityAreas/Grama panchayat/public associations/Government Schemes officers/ campus	Site selection/proper consultation/Continuous monitoring/Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social And economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams /College campus	Group selection/proper consultation/Continuous monitoring/Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stake holders– 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/CityAreas/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 loca schools to achieve good results and enhance their enrolment in Higher/ technical/vocati onal education.	May be indivi dual or team	Local government /private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/Infor mation 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 indivi dual or team	Villages/CityAreas/Grama panchayat/public associations/ Government Schemes officers/ campus	Site selection/proper consultation/ Continuous monitoring/Infor mation board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubric sof scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, SwachhBharat, AtmanirbharBha rath, Make in India, Mudra scheme, Skill development programs etc.	May be indivi dual or team	Villages/CityAreas/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 asper the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs. (minimum5prog rams)	May be indivi dual or team	Villages/CityAreas/Grama panchayat/public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring /Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be indivi dual or team	Villages/CityAreas/Grama panchayat/public associations/Government Schemes officers/ campus	Place selection/proper consultation/Conti nuous 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/CityAreas/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**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 2= 100**
Credits	**00**	**Exam Hours**	**02**

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

22PEDX0.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
22PEDX0.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
22PEDX0.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
22PEDX0.4	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
22PEDX0.1	-	-	-	-	-	2	-	3	3	-	-	2
22PEDX0.2	-	-	-	-	-	2	-	3	3	-	-	2
22PEDX0.3	-	-	-	-	-	2	-	3	3	-	-	2
22PEDX0.4	-	-	-	-	-	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 F. Cardiovascular Endurance – Harvard step Test	22PED30.2, 22PED30.3	15 HRS
	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

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 SiksherRitiniti, 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 Trackand Field, Khel SahityaKendra, NewDelhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, NewDelhi.
6. VivekThani, Coaching Cricket, Khel Sahitya Kendra, NewDelhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K.SarirSikshaParichay, Classic Publishers, Kolkata
9. NaveenJain, Play and Learn Basketball, Khel Sahitya Kendra, NewDelhi.
10. DubeyH.C., Basketball, Discovery Publishing House, NewDelhi.
11. RachanaJain, Teach Yourself Basketball, Sports Publication.
12. JackNagle, Power Pattern Offences for Winning basketball, Parker PublishingCo., NewYork.
13. RenuJain, Play and Learn Basketball, Khe lSahitya Kendra, NewDelhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA			
Course Code	**22YOG30, 22YOG40, 22YOG50, 22YOG60**	**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:

22YOGX0.1	Use Yogasana practices in an effective manner
22YOGX0.2	Become familiar with an authentic foundation of Yogic practices
22YOGX0.3	Practice different Yogic methods such as Surya namaskara, Pranayama and some of the Shat Kriyas
22YOGX0.4	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
22YOGX0.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOGX0.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOGX0.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOGX0.4	-	-	-	-	-	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. **Surya namaskara:** 1. Surya namaskar prayer and its meaning, Need, importance and bene Surya namaskar. 2. Surya namaskar 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, ArdhaUshtrasana, Vakrasana, AakarnaDhanurasana 2. Standing: ParshvaChakrasana, UrdhvaHastothanasana, 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:**		Total 32 Hrs/ Semester

	Different types of Asanas: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali'sAshtangaYoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	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'sAshtangaYoga**: 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):

1. https://youtu.be/KB-TYlgd1wE
2. https://youtu.be/aa-TG0Wg1Ls

BASIC APPLIED MATHEMATICS-II
(Common to all Branches)

Course Code	**22DMAT41**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs. / Week	**2**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**--**

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

22DMAT41.1	Gain knowledge of basic operations of vectors
22DMAT41.2	Use curl and divergence of a vector function in three dimensions
22DMAT41.3	Develop the ability to solve higher order Linear differential equations
22DMAT41.4	Know the basic concepts of Laplace transform to solve the Periodic functions and also solve initial and boundary value problems using Laplace transform method.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22DMAT41.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.4	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**VECTORS**	**22DMAT41.1**	**8 Hours**

Definition of scalar and vector, Vector addition, Subtraction and Multiplication-Dot product, Cross product, Scalar triple product. Orthogonal, Co-planar and Angle between vectors-Problems.

Text Book	Text Book 1: 3.1, 3.5, 3.6, 3.9, Text Book 2: 7.1, 9.2, 9.3, 9.4.

MODULE-2	**VECTOR DIFFERENTIATION**	**22DMAT41.2**	**8 Hours**

Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of a vector function-Problems. Solenoidal and irrotational vector fields-Problems.

Text Book	Text Book 1: 8.5, 8.6, 8.7, Text Book 2: 9.7, 9.8, 9.9.

MODULE-3	**LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS**	**22DMAT41.3**	**8 Hours**

Solution of initial and boundary value problems, Inverse differential operator techniques for the functions-e^{ax}, $\sin(ax + b)$ and $\cos(ax + b)$.

Text Book	Text Book 1: 13.3, 13.4, 13.5, 13.6,

MODULE-4	**LAPLACE TRANSFORM**	**22DMAT41.4**	**8 Hours**

Definition and Laplace transforms of elementary functions-Problems. Properties of Laplace transforms (Shifting property-without proof), Periodic functions (without proof)-problems.

Text Book	Text Book 1: 21.3, 21.4, 21.5, Text Book 2: 6.1.

MODULE-5	**INVERSE LAPLACE TRANSFORM**	**22DMAT41.4**	**8 Hours**

Inverse Laplace Transform by partial fractions-Problems. Solution of linear differential equations using Laplace Transforms-Problems.

Text Book	Text Book 1: 21.12, 21.15, Text Book 2: 6.4.

CIE Assessment Pattern (50 X 2=100 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	-
L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-

Suggested Learning Resources:

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.

Reference Books:

1. Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015,ISBN: 9780273719236.
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/SaNDPSk1UVM?si=FRxMnRi1btCUIscK
2. https://youtu.be/HxrLu-qRJKc?si=pKc9XOCllBx-H4Wp
3. https://youtu.be/ma1QmE1SH3I?si=Hoo3_cjiIds203os
4. https://youtu.be/TKBXey91Gc4?si=JjZfQvJxdxN8I6YQ
5. https://youtu.be/1THkFmuIPXM?si=pc9VvmZ-9cQe_Wr_
6. https://youtu.be/m7jH0jfRf2I?si=OOEWttfQhieJ9wih
7. https://youtu.be/qFnoRfZknBY?si=BeMrhMF3LML4hBGa
8. https://youtu.be/n9XP6pljtw8?si=3gU-XKgt5JIZe9LE

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 Algorithms/Flowcharts/Programming Codes
  - Organizing Groupwise discussions on related topics
  - Seminars

APPENDIX A

List of Assessment Patterns

SLNO	Assessments
1	Continuous Internal Evaluation
2	Assignments
3	Online/Offline Quizzes
4	Mini Projects/ Projects
5	Group Discussions
6	Case studies
7	Practical Activities/Problem Solving Exercises
8	Practical Orientation on design thinking, Creative & Innovation
9	Participatory & Industry-Integrated Activities
10	Class Presentations

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.

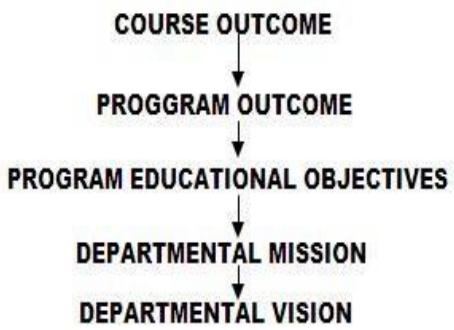
There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineeringdegree 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

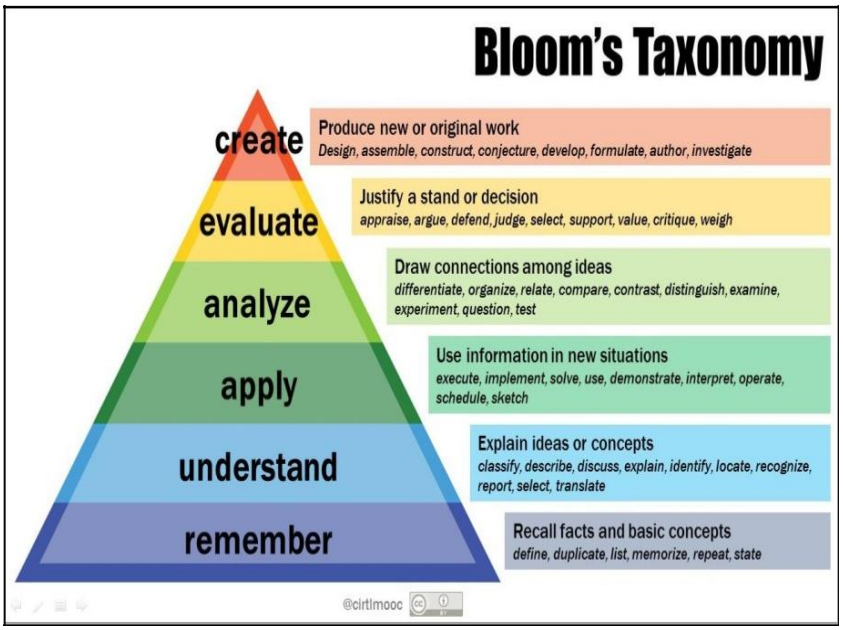


APPENDIX C

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 straight forward 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.