NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Science and Engineering (Data Science)

Academic Year 2025-26

3rd and 4th Semester

Scheme and Syllabus

BATCH: 2024-28

CREDITS: 160

NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering studentswith 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 ANDENGINEERING (DATA SCIENCE)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

<u>UG – Engineering Program</u>

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

NEW HORIZON COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

VISION

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

MISSION

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

PROGRAM 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.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	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.
PEO2	Collaborate proficiently with experts from diverse fields and actively engage in continuous professional growth in the domain of computing.
PEO3	Possess the ability to think logically and the capacity to understand technical problems with computational systems.
PEO4	Possess the ability to collaborate as team members and team leaders to facilitate cutting-edge technical solutions for computing systems and thereby providing improved functionality.

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Science and Engineering (Data Science)

Scheme of Teaching and Examinations for 2024- 2028 BATCH (2024 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	24MAC31/ 24MAE31	Numerical Methods and Probability	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	24CSK32	Advanced Data Structures	CS	3	0	0	0	3	3	50	50	**100**
3	PCCL	24CSLK32	Advanced Data Structures Lab	CS	0	0	1	0	1	2	50	50	**100**
4	PCC	24CSK33	Digital Logic and Computer Organization	CS	3	0	0	0	3	3	50	50	**100**
5	PCCL	24CSLK33	Logic Design Lab	CS	0	0	1	0	1	2	50	50	**100**
6	PCC	24CSK34	Optimization Techniques	CS	3	0	0	0	3	3	50	50	**100**
7	PCC	24CSK35	Software Engineering and Project Management	CS	3	0	0	0	3	3	50	50	**100**
8	AEC	24CDS36X	Ability Enhancement Course – III	DS	If the course is a Theory						50	50	**100**
					1	0	0	0	1	1			
					If the course is a Laboratory								
					0	0	1	0	1	2			
9	UHV	24DTK37	Design Thinking and Fabrication	ME	1	0	0	0	1	1	50	--	**50**
10	NCMC	24NSS30	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED30	Physical Education and Sports	-									
		24YOG30	Yoga	-									
Total									**19**	**23/25**	**500**	**400**	**900**

11	NCMC	24DMAT31*	Basic Applied Mathematics -I	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

24DMAT311*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Ability Enhancement Course – III (0-0-1-0)			
24CDS361	Web Design Technologies	24CDS364	Advanced Excel for Data Analysis
24CDS362	R Programming for Data Science	24CDS365	Bio Inspired Design and Innovation (1-0-0-0)
24CDS363	Project Management with Git		

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 2024- 2028 BATCH (2024 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	24MAC41/ 24MAE41	Discrete Mathematics and Graph Theory	BS	3	0	0	0	3	3	50	50	**100**
2	PCC	24CSK42	Object Oriented Programming using Java	CS	3	0	0	0	3	3	50	50	**100**
3	PCCL	2CSLK42	Object Oriented Programming using Java LAB	CS	0	0	1	0	1	2	50	50	**100**
4	PCC	24CSK43	Operating Systems	CS	3	0	0	0	3	3	50	50	**100**
5	PCCL	24CSLK43	Operating Systems Lab	cs	0	0	1	0	1	2	50	50	**100**
6	PCC	24CSK44	Database Management System	CS	3	0	0	0	3	3	50	50	**100**
7	PCCL	24CSLK44	Database Management System Lab	CS	0	0	1	0	1	2	50	50	**100**
8	PEC	24CDS45X	Professional Elective Course-I	DS	3	0	0	0	3	3	50	50	**100**
9	AEC	24CDS46X	Ability Enhancement Course – IV	DS	If the course is a Theory						50	50	**100**
					1	0	0	0	1	1			
					If the course is a Laboratory								
					0	0	1	0	1	2			
10	UHV	24UHK47	Universal Human Values and Life Skills	Any Dept	1	0	0	0	1	2	50	--	**50**
11	PROJ	24CDS48	Mini Project	DS	0	0	1	0	1	0	50	50	**100**
12	NCMC	24NSS40	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED40	Physical Education and Sports	-									
		24YOG40	Yoga	-									
Total									**21**	**25/27**	**600**	**500**	**1100**

13	NCMC	24DMAT41*	Basic Applied Mathematics-II	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, **PROJ**: Mini Project work, **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.

24DMAT41*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Professional Elective Course-I			
24CDS451	Data Engineering	24CDS454	Computer Graphics
24CDS452	Principles of Cloud Computing	24CDS455	Fundamentals of Information Security
24CDS453	Business Analytics	24CDS456	Entrepreneurship and Innovation Management

Ability Enhancement Course – IV (For IT allied Branches, all are Laboratory Courses 0-0-1-0) (Other branches can have 1-0-0-0 or 0-0-1-0)			
24CDS461	Data Visualization	24CDS464	C# and .NET
24CDS462	Ethical Hacking Practices	24CDS465	Cloud-based Collaborative Workspace
24CDS463	Programming for UI and UX design		

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

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

CIE procedure for Mini-project:

i. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.
ii. **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

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

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

III
Semester

NUMERICAL METHODS AND PROBABILITY

(Common to AIM,CSE,CDS)

Course Code	**24MAC31**	**CIE Marks**	**50**
L:T:P:S	**2:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course outcomes:

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

24MAC31.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations.
24MAC31.2	Solve initial value problems using appropriate numerical methods and also Evaluate definite integrals numerically.
24MAC31.3	Demonstrate the idea of Linear Dependence and Independence of sets in the vector space.
24MAC31.4	Gain ability to use probability distributions to analyze and solve real time problems
24MAC31.5	Justify the concept of sampling distribution to solve the engineering problems and 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
24MAC31.1	3	3	-	-	-	-	-	-	-	-	-	-
24MAC31.2	3	3	-	-	-	-	-	-	-	-	-	-
24MAC31.3	3	3	-	-	-	-	-	-	-	-	-	-
24MAC31.4	3	3	-	-	-	-	-	-	-	-	-	-
24MAC31.5	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**NUMERICAL SOLUTIONS AND INTERPOLATION**	**24MAC31.1**	**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.

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 SOLUTIONS TO DIFFERENTIAL EQUTIONS, INTEGRATION**	**24MAC31.2**	**8 Hours**

Numerical solution of ordinary differential equations of first order and of first degree: Taylor's series method, Modified Euler's 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. 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**	**24MAC31.3**	**8 Hours**

Vector Space definition and examples, Subspaces and Spanning sets, Linear Dependence and Independence, Linear Independence and Spanning Sets, Bases: Orthogonal and Orthonormal 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**	**24MAC31.4**	**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.			
Text Book	Text Book 1: 25.12, 25.13, 26.8, 26.9, 26.10, 26.11, 26.12, 26.14, 26.15, 26.16.		
MODULE-5	**SAMPLING THEORY**	**24MAC31.5**	**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.			
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, 27.17, 27.18, 27.19,		

List of Tutorial Contents

Sl. No.	Contents	COs
1.	Use Newton's forward formula for equal interval problems.	24MAC31.1
2.	Use Newton's backward formula for equal interval problems.	24MAC31.1
3.	Uses of Simpson's $1/3^{rd}$ rule problems	24MAC31.2
4.	Uses of Simpson's $3/8^{th}$ rule problems	24MAC31.2
5.	Use Wronskian to test a set of solutions of a linear homogeneous differential equation for linear independence.	24MAC31.3
6.	Identify and sketch the graph of a conic section and perform a rotation of axes.	24MAC31.3
7.	Use of Binomial Distribution in real life problems.	24MAC31.4
8.	Use of Normal Distribution in real life problems.	24MAC31.4
9.	Use Student's t-distribution to test goodness of fit for small samples.	24MAC31.5
10.	Use Chi-square distribution to test goodness of fit for small samples.	24MAC31.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	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**	**5**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**15**
L5	**Evaluate**	**10**
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)
  - Problem solving Approach
  - Organizing Group wise discussions on related topics
  - Seminars

ADVANCED DATA STRUCTURES			
Course Code	**24CSK32**	**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:

24CSK32.1	Understand the fundamentals of data structures and their applications essential for Programming/Problem Solving.
24CSK32.2	Examine the operational aspects of linear data structures: stacks, queues.
24CSK32.3	Analyze the behavior and performance of linked lists to address data organization challenges.
24CSK32.4	Demonstrate the operational aspects of Tree data structures for optimized data hierarchy and retrieval.
24CSK32.5	Demonstrate the operational aspects of Graph data structures for modeling and traversing.
24CSK32.6	Investigate the sorting methods and hashing techniques for optimizing data access, storage, and retrieval.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSK32.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CSK32.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CSK32.3	3	3	3	-	-	-	-	-	-	-	-	3	3
24CSK32.4	2	2	3	-	-	-	-	-	-	-	-	3	3
24CSK32.5	3	3	3	-	-	-	-	-	-	-	-	3	3
24CSK32.6	2	2	3	-	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION**	**24CSK32.1**	**8 Hours**

Data Structures, Classifications, Data Structure Operations, Array Operations: Traversing, inserting, deleting. Multidimensional Arrays, Strings, Structures, Self- Referential Structures, Unions. Pointers -Pointer as function arguments, Dynamic Memory Allocation Functions.

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**	**24CSK32.2**	**8 Hours**

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

Text Book	Text Book 1:3.1,3.3,3.4, Text 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**	**24CSK32.3**	**8 Hours**
Introduction to Linked List, Representation of linked list in memory, Single Linked List, Doubly-linked list, Header linked list, Linked representation of stack, Linked representation of queue, Circular linked list, , Operations on linked lists, Applications of Linked List – Polynomials Representation, Addition of two polynomials.			
Text Book	Text Book 1: 4.1,4.2,4.4,4.5,4.8		
MODULE-4	**TREES**	**24CSK32.4**	**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, Red-Black Trees, Application of Trees-Evaluation of Expression			
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, SORTING & HASHING**	**24CSK32.5, 24CSK32.6**	**8 Hours**
Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting- Quick Sort, Merge Sort, Stable vs. Unstable sort, 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		

CIE Assessment Pattern (50 Marks – Theory)

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

***Alternate Assessment-1 &2: MCQs= 5 marks; Problem solving based question= 2.5 marks (Coding Platform)**
***Alternate Assessment-3: MCQs= 5 marks; Problem solving based question= 5 marks (Coding Platform)**

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, **ISBN-13:** 978-0716782506
2. Debasis Samanta: Classic Data Structures,2nd Edition, PHI, 2009, **ISBN-13:** 978-8120337312

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: "Data Structures using C and C++,2nd Edition, Pearson Education, 2003, ISBN :8131702294, 788131702291.
2. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning,2005, **ISBN-13:** 978-8131503140.
3. K.V. Sambasivarao, *Data Structures*. S. Chand Publishing, 2024. ISBN-13: 978-9358704730.
4. Reema Thareja, *Data Structures Using C*. Oxford University Press, 3rd Edition, 2023. ISBN-13: 978-0199491689.

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	**24CSLK32**	**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:

24CSLK32.1	Apply the concepts of Arrays and Structures for Programming and Problem Solving.
24CSLK32.2	Examine the operational aspects of linear data structures: stacks, queues for efficient data management.
24CSLK32.3	Analyze the behavior and performance of linked lists to address data organization challenges.
24CSLK32.4	Demonstrate the operational aspects of non-linear data structures: Trees, Graphs in Programming.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO2
24CSLK32.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CSLK32.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CSLK32.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CSLK32.4	-	-	3	3	3	-	-	-	-	-	-	3	3

Pgm. No.	List of Programs	Hours	Cos
	Prerequisite Programs		
	• Basic C Programs (Arrays, User defined Functions, Structures, Pointers) • Basic Commands in Linux	2	NA
	PART-A		
1a.	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 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	24CSLK32.1
2b.	Design, Develop and Implement a Program in C to create a structure to store the name, account number and balance of 3 and store their information. a. Write a function to print the names of all the customers having balance less than **MINIMUM_AMOUNT**. b. Write a function to add **BONUS_AMOUNT** in the balance of all the customers having more than $1000 in their balance and then print the incremented value of their balance	2	24CSLK32.1
3c.	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	2	24CSLK32.2

	appropriate functions for each of the above operations		
4a.	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	24CSLK32.2
5a.	Design, Develop and Implement a Program in C for the following Stack Application: Evaluation of Postfix expression with single digit operands and operators: +, -, *, /, %, ^.	2	24CSLK32.2
6a.	Design, Develop and Implement a Program in C for the following Stack Application: Solving Tower of Hanoi problem with n disks.	**2**	24CSLK32.**2**
	PART-B		
1b.	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	24CSLK32.2
2b.	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		24CSLK32.3
3b.	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	24CSLK32.3
4b.	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	24CSLK32.3
5b.	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 in-order, Preorder and Post-Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit	2	24CSLK32.4

6b.	Demonstrate the Binary Search algorithm by first sorting the list of elements using any one of the standard sorting techniques. a. The program should accept a list of elements, sort them in ascending order, and then perform a Binary Search to find a given target element. b. Display appropriate messages indicating whether the element was found and its position.	2	24CSLK32.4

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/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	

*** SEE EXAM:** Students will be assigned one program from Part A and one program from Part B**.**

Suggested Learning Resources:

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Fundamentals of Data Structures in C. University Press, 2012, **ISBN-13:** 978-0716782506
2. Debasis Samanta: Classic Data Structures,2nd Edition, PHI, 2009, **ISBN-13:** 978-8120337312
3. Yedidyah, Augenstein, Tannenbaum: "Data Structures using C and C++, 2nd Edition, Pearson Education, 2003, ISBN:8131702294, 788131702291**.**
4. Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning,2005, **ISBN-13:** 978-8131503140**.**
5. K.V. Sambasivarao, *Data Structures*. S. Chand Publishing, 2024. ISBN-13: 978-9358704730.
6. Reema Thareja, *Data Structures Using C*. Oxford University Press, 3rd Edition, 2023. ISBN-13: 978-0199491689.

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**

DIGITAL LOGIC AND COMPUTER ORGANIZATION

Course Code	**24CSK33**	**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:

24CSK33.1	Apply fundamental digital logic design concepts and techniques to solve problems in digital circuit design.
24CSK33.2	Analyze and implement combinational logic circuits and their real-time applications.
24CSK33.3	Evaluate sequential logic design techniques for real-world digital system implementation.
24CSK33.4	Design and simulate combinational and sequential logic circuits using Verilog HDL.
24CSK33.5	Investigate and interpret the implementation of arithmetic operations within a hardwired control unit.
24CSK33.6	Evaluate memory management techniques, instruction execution methods and I/O mechanisms.

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSK33.1	3	3	3	3	-	-	-	-	-	-	-	-	-
24CSK33.2	3	3	3	-	-	-	-	-	-	-	-	2	-
24CSK33.3	3	3	2	-	-	-	-	-	-	-	-	2	-
24CSK33.4	3	3	3	3	3	-	-	-	-	-	-	-	3
24CSK33.5	3	3	3	2	-	-	-	-	-	-	-	-	-
24CSK33.6	3	3	3	2	-	-	-	-	-	-	-	2	-

MODULE-1	**DIGITAL LOGIC ESSENTIALS**	**24CSK33.1**	**8 Hours**

Introduction to Number Systems, Boolean Algebra, K-Map simplification method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Variable Entered K-MAP(VEM), Quine-McCluskey minimization technique, Reduced prime implicate tables, , Introduction to Verilog HDL.

Case study	Create a secure lock system using a 4-digit binary passcode.
Text Book	Textbook -1: Ch-3, 4.6

MODULE-2	**COMBINATIONAL CIRCUITS**	**24CSK33.2 24CSK33.4**	**8 Hours**

Adders, Subtractors, Carry Look Ahead Adder, Parallel Adder Multiplexers, De-multiplexers, Decoders, encoder, Priority Encoders, Magnitude Comparator, Parity generator and checker, Verilog implementation of combinational circuit.

Applications	Design a simple ALU capable of performing addition, subtraction, comparison, and parity check.
Text Book	Textbook -1: Ch- 4

MODULE-3	APPLICATION OF SEQUENTIAL CIRCUITS	24CSK33.3 24CSK33.4	8 Hours
Types of Flip Flop, Conversion of Flip-flops, Shift Register, Types of Shift Registers, Universal Shift Register, Applications of Shift Register, Binary ripple counters, Synchronous binary counters, Design of a synchronous mod-n counter using clocked T, JK, D and SR flip-flops, Verilog implementation of Flip-flop, Shift registers and Counters.			
Case study	Design and Implementation of a Digital Sequence Detector Using Shift Registers and Flip-Flops.		
Text Book	Textbook 1 –Ch-5, 6		
MODULE-4	**ARITHMETIC FOR COMPUTER**	**24CSK33.5**	**8 Hours**
Signed and Unsigned Numbers representation and 2's complement arithmetic operation, Floating Point number representation, Multiplication of unsigned and signed numbers, Array multiplication, Sequential multiplication, Booth's multiplication, Bit pair Fast multiplication, Restore and Non-restore Integer Division.			
Applications	Design of a Binary Arithmetic Processing Unit (APU)		
Text Book	Textbook-2: Ch-2, 3		
MODULE-5	**COMPUTER OPERATION PRINCIPLES**	**24CSK33.6**	**8 Hours**
Fundamental Blocks of Computer, Classification of Computers- RISC and CISC, Instruction and Instruction sequencing, Addressing Modes, Accessing I/O Devices, Interrupts, Enabling and Disabling Interrupts, Memory Location and Addresses, Memory Operations, Cache Memory, Cache mapping techniques, Replacement algorithms, Write policies.			
Case study	Design and Analysis of Cache Mapping in a Mini CPU Architecture		
Text Book	Textbook-2: 4, 5		

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Digital Design: with an Introduction to Verilog HDL, VHDL and System Verilog, M Morris Mano and Michael D. Ciletti, 6th Edition, 2018, Pearson Education, ISBN-978- 9353062019.
2. Computer Organization and Design: The Hardware/Software Interface: RISC-V Edition, David A. Patterson, John L. Hennessy, Morgan Kaufmann (Elsevier), 2nd Edition, 2024, ISBN: 978-0128203316

Reference Books:

1. Computer Arithmetic: Algorithms and Hardware Designs, Behrooz Parhami, Oxford University Press, 2nd Edition, 2023(reprint), ISBN-13: 978-0195328486
2. Digital Design and Computer Architecture, David Harris and Sarah Harris, Morgan Kaufmann (Elsevier), 3rd Edition, 2022, ISBN: 978-0128200643
3. Fundamentals of Digital Logic with Verilog Design, Stephen Brown and Zvonko Vranesic, McGraw-Hill Education, 3rd Edition, 2023, ISBN: 978-0073380544

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/117105080
- https://ocw.mit.edu/courses/6-004-computation-structures-spring-2017/
- https://www.coursera.org/learn/comparch
- https://www.edx.org/learn/design/the-hong-kong-university-of-science-and-technology-digital-design

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

- **Logic Puzzle Challenges**: Logic puzzles and challenges related to digital circuits. These can include tasks like designing specific logic gates or solving circuit problems. Puzzles can be individual or team-based.
- **Industry Case Studies**: Discussion on the challenges and solutions employed in various industries, such as aerospace, automotive, or consumer electronics.
- **Peer Teaching**: The students can be asked to teach and discuss specific topic or concept to their peers. This not only reinforces their own understanding but also encourages active engagement and collaboration.
- **Reflection and Discussion**: The students can be asked to present their learning of any topic with others. This will encourage students to reflect on their experiences and discuss what they learned. This promotes critical thinking and deeper understanding.

LOGIC DESIGN LABORATORY

Course Code	**24CSLK33**	**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:

24CSLK33.1	Design and deploy modular combinatorial logic circuits
24CSLK33.2	Synthesize sequential logic circuits with a focus on design and implementation.
24CSLK33.3	Construct and perform Verilog simulations to implement combinational circuitry effectively.
24CSLK33.4	Execute Verilog simulations to implement sequential circuits with precise construction.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSLK33.1	3	3	3	3	-	-	-	-	-	-	-	-	-
24CSLK33.2	3	3	3	3	-	-	-	-	-	-	-	-	-
24CSLK33.3	3	3	3	3	3	-	-	-	-	-	2	2	-
24CSLK33.4	3	3	3	3	3	-	-	-	-	-	2	2	-

Exp. No.	List of Experiments	Hours	COs
	Prerequisite		
	• Simple Boolean functions • Number conversions	2	NA
	PART-A		
1a.	Design and verify the Full Adder and Subtractor circuit using basic logic gates.	2	24CSLK33.1
2a.	Design and verify the Parallel Adder/ Subtractor using IC 7483	2	24CSLK33.1
3a.	Design and verify the 4-variable function using IC 74151(8:1MUX).	2	24CSLK33.1
4a.	a) Design and implement the BCD to Gray code using NAND gates. b) Design and implement the Binary to excess-3 circuits using Gates (4 bit)	2	24CSLK33.1
5a.	Implement and verify SISO, PIPO, SIPO, PISO, Left shift, Ring Counter and Johnson Counter using IC 7495.	2	24CSLK33.2
6a.	Design and implement synchronous up Mod-N (N<8) Counter using JK flip flop.	2	24CSLK33.2
	PART-B		
1b.	Write a Verilog code to simulate the following circuit: a) Adder and Subtractor	2	24CSLK33.3

	b) Parallel adder		
2b.	Write a Verilog code to simulate the following circuit: a) MUX b) De-MUX	2	24CSLK33.3
3b.	Write a Verilog code to simulate the following circuit: a) Encoder b) Decoder	2	24CSLK33.3
4b.	Write a Verilog code to simulate the following circuit: a) Magnitude comparator b) Code converter	2	24CSLK33.4
5b.	Write a Verilog code to simulate the following circuit: a) Flip flops b) Shift Registers	2	24CSLK33.4
6b.	Write a Verilog code to simulate the following circuit: a) Ring Counter and Johnson Counter b) Synchronous up and down counter	2	24CSLK33.4

PART-C

Beyond Syllabus Virtual Lab Content

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

- **https://da-iitb.vlabs.ac.in/exp/washin-machine-control/**
- **https://da-iitb.vlabs.ac.in/exp/seat-belt-warning-system/**
- **https://da-iitb.vlabs.ac.in/exp/water-level-control/**
- **https://da-iitb.vlabs.ac.in/exp/cockpit-warning-light-control/**

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1. Electronics for Beginners: A Practical Guide to Components, Logic Circuits, and Digital Systems for Students and Hobbyists Kindle Edition 2025, ISBN: 979-8288621642
2. Verilog HDL Design Examples - Joseph Cavanagh, 2018, CRC Press, Taylor & Francis group, ISBN-9781138099951
3. Verilog for Digital Design and Simulation: Definitive Reference, Richard Johnson,2025, ISBN: 6610000839827

OPTIMIZATION TECHNIQUES

Course Code	**24CSK34**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24CSK34.1	Apply the mathematical formulations for solving linear part programming
24CSK34.2	Analyze the optimization methods for real life problems.
24CSK34.3	Apply the transportation and assignment algorithm for real life problems
24CSK34.4	Develop the optimal solutions for network analysis by PERT and CPM
24CSK34.5	Analyze the sequence of jobs on various machines.
24CSK34.6	Illustrate the significance of Game theory for decision support systems.

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

	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSK34.1	3	1	-	-	-	1	-	-	-	-	1	-	-
24CSK34.2	2	2	-	-	1	1	-	-	-	1	1	-	1
24CSK34.3	3	3	-	2	1	2	-	-	-	-	1	1	2
24CSK34.4	-	-	3	-	2	1	-	2	-	2	1	2	2
24CSK34.5	3	2	-	-	1	1	-	-	-	-	-	-	1
24CSK34.6	2	2	-	1	1	1	1	-	-	-	1	2	1

MODULE-1	**OPTIMIZATION TECHNIQUES AND LINEAR PROGRAMMING**	**24CSK34.1**	**8 Hours**

INTRODUCTION: Evolution, Definitions, and Applications of Optimization Techniques, models used in OT**,** Characteristics and phases of OT, computer software for OT.

LINEAR PROGRAMMING: Mathematical formulation of Linear Programming Problems, Graphical solution methods, The Algebraic Method.

Case Study	Explain optimization techniques for various problems with case study. Specific case study: Choosing the Best School (Text Book1: Chapter 1)
Text Book	Text Book 1: Chapter 1,2 Text Book 3: Chapter 1

MODULE-2	**OPTIMIZATION METHODS**	**24CSK34.2**	**8 Hours**

The simplex method -slack, surplus and artificial variables. Optimization – optimal problem formulation, engineering optimization problems, optimization algorithms, numerical search for optimal solution, Monte Carlo method

Case Study / Applications	Applications of Optimization Techniques Specific Case Study: The Write well Pen Company (Text Book1: Chapter 3)
Text Book	Text Book 1: chapter 2,3 Text book 3: Chapter 2,3

MODULE-3	TRANSPORTATION AND ASSIGNMENT PROBLEMS	24CSK34.3	8 Hours

TRANSPORTATION: Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, prohibited route, maximization problems, Applications of Transportation problems.

ASSIGNMENT: Formulation, Hungarian method, maximization problem, restrictions on assignments unbalanced assignment problem, Travelling salesman problem.

Case Study/ Applications	Case study on Transportation and Assignment by taking real time examples. Specific Case Study: The Fountain Pen Company, Western Constructions (TB Ch.6)
Text Book	Text Book 1: chapters 4 ,5 Text Book 3: Chapters 5,6

MODULE-4	NETWORK ANALYSIS	24CSK34.4	8 Hours

Introduction, Construction of networks, Fulkerson's rule for numbering the nodes, AON and AOA diagrams; Critical path method to find the expected completion time of a project, determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Case Study/ Applications	Case study on PERT and CPM by taking real time examples. Specific case study: the wafer electronics company (TB1: Ch 9)
Text Book	Text Book 1: Chapter 8, 9

MODULE-5	SEQUENCING AND GAME THEORY	24CSK34.5, 24CSK34.6	8 Hours

SEQUENCING: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule - 'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' Machines. Sequencing 2 jobs on 'm' machines using graphical method

GAME THEORY: Formulation of games, Two Person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property,

Introduction to Metaheuristics: simulated annealing, Tabu Search, Genetic Algorithms

Case Study	Case study on sequencing and game theory by taking real time examples.
Text Book	Text Book 2 and 3: Chapter 7 and 8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		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. Operations Research: Principles and Applications, G Srinivasan, Eastern Economy Edition, ISBN: 9788120353107
2. Operations Research, S Kalavathy; 4th edition, 2013, ISBN- 13- 978-9325963474
3. Operation Research, M Srinivas Reddy, Sanguine Technical Publication, 3rd Edition, ISBN:978-9383506149

Reference Books

1. Operation Research, Gupta Prem Kumar, Hira D.S Revised edition 2021, ISBN-13: 978-8121902816
2. Operations Research: An Introduction, H A Taha, Pearson; 10th edition, 2019, ISBN- 13-978-9352865277
3. Introduction to Operation Research, Frederick S. Hillier, Gerald J. Lieberman, McGraw-Hill Education; 10th edition 2021, ISBN- 13-978-9354601200

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=bw-NvGvLHtM
- https://www.youtube.com/watch?v=xrGVe6gMRyk
- https://www.youtube.com/watch?v=M8POtpPtQZc
- https://www.youtube.com/watch?v=ItOuvM2KmD4
- https://www.youtube.com/watch?v=rrfFTdO2Z7I
- https://www.youtube.com/watch?v=vUMGvpsb8dc&list=PLabr9RWfBcnpRfJuZWcEOthynn1Smu5_S
- https://www.youtube.com/watch?v=WrAf6zdteXI
- https://www.youtube.com/watch?v=jonespBF9yk
- https://www.youtube.com/watch?v=fSuqTgnCVRg&list=PLabr9RWfBcnp8CT6my-Q89N0o-E6tcM6q

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

- Demonstration of implementation of Linear Programming in industries.
- Demonstration of implementation of transportation and assignments in industries.
- Demonstration of implementation of PERT and CPM in industries.
- Demonstration of implementation of game theory and sequencing in industries.

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

Course Code	**24CSK35**	**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:

24CSK35.1	Apply appropriate software process models to solve real-world software engineering problems using the principles of the SDLC
24CSK35.2	Use standard SRS templates to prepare clear and testable requirement documents for the given project.
24CSK35.3	Analyze modeling techniques such as DFDs and UML diagrams for effective software design.
24CSK35.4	Analyze how people, products, processes, and projects interact to guide software management strategies.
24CSK35.5	Analyze reactive and proactive risk strategies to evaluate their impact on the software project outcome
24CSK35.6	Evaluate software risk factors by systematically identifying, projecting, refining, and prioritizing mitigation strategies within a coherent RMMM plan

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

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
24CSK35.1	2	-	2	-	2	2	-	2	-	-	2	-	-
`24CSK35.2	2	-	2	-	2	2	-	2	-	-	2	-	-
24CSK35.3	2	2	3	3	3	3	-	3	-	-	3	-	-
24CSK35.4	2	2	3	3	3	3	-	3	-	3	3	-	-
24CSK35.5	2	2	2	2	2	2	-	2	-	2	3	-	-
24CSK35.6	2	2	2	2	2	2	-	2	-	2	3	-	-

MODULE-1	**INTRODUCTION TO SOFTWARE ENGINEERING AND PROCESS MODELS**	**24CSK35.1**	**8 Hours**

Introduction: Software Engineering, Software Process, Software Development Life Cycle.

Process models: Waterfall model, Prototype model, Evolutionary process models, Unified Process model, iterative waterfall model, Incremental process models, Spiral model, Agile Development Model.

Case study	Software Process Models (Waterfall, Prototyping, Evolutionary, Spiral, Unified, Agile): • Select one or more process models to study in depth. • Analyze case studies of projects that successfully used each model to understand their practical applications.
Text Books	Text Book 1: Chapter 1.1 to 1.4, and 2.1 to 2.6, 4.1 Text book 2: Chapter 1.1,2.2,2.4

<table>
<tr><td>MODULE-2</td><td>REQUIREMENTS ENGINEERING</td><td>24CSK35.2</td><td>8 Hours</td></tr>
<tr><td colspan="4">Types of requirements, User requirements, System requirements, Functional and Non-functional requirements, Software requirements document, requirements specifications, requirement engineering process, Feasibility study, Requirements elicitation and analysis, Requirements validation, Requirements management.</td></tr>
<tr><td>Applications</td><td colspan="3">Identify a simple software project or system and draw SRS for the same</td></tr>
<tr><td>Text Book3</td><td colspan="3">Text Book 3: Chapter 4.1 to 4.7</td></tr>
<tr><td>MODULE-3</td><td>SOFTWARE DESIGN</td><td>24CSK35.3</td><td>8 Hours</td></tr>
<tr><td colspan="4">Approaches to Software Design: Developing the Data Flow Diagram, UML diagram, Use case diagrams, Class diagram, interaction diagram, activity diagram, and state chart diagrams.</td></tr>
<tr><td>Applications</td><td colspan="3">Identify a simple software project or system and draw the corresponding DFD, UML, Class, interaction, activity and state chart diagrams</td></tr>
<tr><td>Text Book</td><td colspan="3">Text Book 2: 6.2, 7.2 to 7.8</td></tr>
<tr><td>MODULE-4</td><td>MANAGING SOFTWARE PROJECTS</td><td>24CSK35.4</td><td>8 Hours</td></tr>
<tr><td colspan="4">Project Management Concepts: The Management Spectrum, People, Product, Process and Project.
Project Planning: Creating a viable Software plan, Project planning process, Resources, data analytics and software project estimation, decomposition and estimation techniques</td></tr>
<tr><td>Applications</td><td colspan="3">You are part of a software team tasked with developing a Campus Placement Portal for a consortium of engineering colleges. The portal must support student registration, company onboarding, automated scheduling, and analytics.
• Apply the Management Spectrum: Understand how people, product, process, and project dynamics influence outcomes.
• Create a viable software plan including scope, deliverables, timeline, and risk considerations.
• Execute project decomposition and resource estimation using industry techniques.</td></tr>
<tr><td>Text Book</td><td colspan="3">Text Book 1: Chapter 24.1 to 24.6, Chapter 25.1 to 25.6</td></tr>
<tr><td>MODULE-5</td><td>RISK MANAGEMENT</td><td>24CSK35.5, 24CSK35.6</td><td>8 Hours</td></tr>
<tr><td colspan="4">Reactive versus proactive Risk Strategies, software Risks, Risk Identification, Risk Projection, Risk refinement, Risk mitigation, monitoring and management, The RMMM plan.</td></tr>
<tr><td>Case Study</td><td colspan="3">Risk Strategy in E-Ticketing System Upgrade
Key Risks to be Identified:
• Technical: API failures with third-party payment gateways
• Operational: Lack of mobile testing resources
• External: New regulatory compliance for digital ticketing
• Proactive Steps:
1. Identified key risks using brainstorming and past incident logs
2. Created a mitigation list and incorporated it into a unified RMMM plan
• Reactive Handling:
a. A payment service disruption was resolved via backup gateway integration
b. Emergency testing sprint addressed mobile app crashes</td></tr>
<tr><td>Text book 1</td><td colspan="3">Text Book 1: Chapter 26: 26.1 to 26.7</td></tr>
</table>

CIE Assessment Pattern (50 Marks – Theory)

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

* **AAT1: Case Study with Report**

***AAT2: Online certification course(free)**

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. R. S. Pressman and Bruce Maxim, Software Engineering: A Practitioner's Approach, 9/e, McGraw-Hill, 2020, ISBN-13: 9781259872976
2. Rajib Mall, Fundamentals of software engineering, 5th edition, PHI Learning Private Limited 2018, ISBN-13: 9788120351658
3. Software Engineering, Ian Sommerville, Pearson Education, Tenth Edition, 2016, ISBN-13: 978-0-13-394303-0

Reference Books:

1. Software Engineering, Chandramouli, Pearson Education, first edition, 2015, ISBN-13: 9789332537293
2. Software Project Management: A Unified Framework, Walker Royce, first edition, 1998, ISBN-13: 9788177583786
3. Managing Global Software Projects, McGraw-Hill Education (India), Gopalaswamy Ramesh, Fourteenth Reprint 2013, ISBN-13: 9780070598973
4. Effective Software Project Management. Robert K. Wysocki – Wiley Publication, 2011, ISBN-13: 978-0-470-12107-8

Web links and Video Lectures (e-Resources):

- **https://www.coursera.org/learn/introduction-to-software-engineering**
- **https://www.udemy.com/courses/development/software-engineering/?srsltid=AfmBOor5x5ldCizp1dXfnY9RvF7fYyhshBGixnAxyR7XM3Q1iYg4tD_2**
- **https://www.edx.org/learn/software-engineering**
- **https://onlinecourses.nptel.ac.in/noc20_cs68/preview**
- **https://alison.com/course/project-management-s-fundamentals**
- **https://www.coursera.org/courses?query=software%20project%20management&msockid=336a577a6ec56ab12f9546416f686b63**
- **https://software-engineering-book.com/slides/**

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

- PPT presentation on case studies with a team of students
- Role Play

WEB DESIGN TECHNOLOGIES

Course Code	**24CDS361**	**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:

24CDS361.1	Apply fundamental web development principles to design and create semantically structured web pages using HTML5 and CSS.
24CDS361.2	Apply client-side scripting using JavaScript to implement dynamic functionalities and browser-based data handling.
24CDS361.3	Develop server-side programs using PHP to manage sessions, cookies, and database operations for dynamic web applications.
24CDS361.4	Apply XML, XSLT, and jQuery techniques to design structured, data-driven web interfaces with interactive functionality.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS361.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS361.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS361.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS361.4	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic Programming Knowledge (C, Python) • Fundamentals of Internet and Web Concepts	2	NA
	PART-A		
1	Develop an XHTML file that simulates a college website. Include features such as form inputs for student registration, internal page links, external hyperlinks, framed layout for navigation, and tabular data to display course offerings or schedules.	2	24CDS361.1
2	Design a shopping website using HTML and DHTML. Incorporate formatted product descriptions using text tags, embed relevant images, and apply inline, internal, and external CSS to showcase styling techniques like hover effects, transitions, and layout adjustments.	2	24CDS361.1
3	Create an XHTML document using HTML5 Canvas to allow users to draw basic shapes (e.g., circles, rectangles). Use Local Storage to save and retrieve user.	2	24CDS361.1
4	Design a book repository web page using XHTML. Include form fields to allow users to input a Book ID or Title. Implement basic JavaScript to simulate	2	24CDS361.2

	retrieval of corresponding book details from a predefined data set and display the results dynamically.		
5	Develop and demonstrate an XHTML file with JavaScript scripts that serve basic health and fitness tracking purposes. **a) Step Counter Simulation (Using Fibonacci Logic)** • Prompt the user to enter the number of days n. • Display the total number of steps walked each day in table format. b) **BMI Table Generator** • Prompt the user to enter the number of people n. • For each person (1 to n), display their hypothetical weight (e.g., weight = 50 + i*2) and height (e.g., height = 150 + i*5 in cm). • Calculate and display their BMI = weight / (height in meters)^2 using alert() boxes.	2	24CDS361.2
6	a) Create an XHTML page with three paragraph elements stacked vertically with partial visibility. On mouse hover, bring the paragraph to the top layer and fully display it using CSS z-index and JavaScript events. b) Modify the behaviour so that when a paragraph leaves the top layer, it returns to its original position instead of going to the bottom, preserving original order dynamically.	2	24CDS361.2
PART-B			
7	Write a PHP program for a news website that stores the date and time of the user's last visit in a cookie and displays a message like "You last visited on [date-time]" upon return.	2	24CDS361.3
8	Create a PHP program that uses session variables to keep track of the number of times a user has refreshed or visited the page during a session. Display the current count on the web page dynamically.	2	24CDS361.3
9	Write a PHP program that allows users to register for a webinar by entering their name and age. Store the data in a MySQL database and display a list of current registrations.	2	24CDS361.3
10	Design an XML document to maintain employee records for an IT company. Include fields like Employee ID, Name, Department, Year of Joining, and Email. Style the display using an external CSS stylesheet.	2	24CDS361.4
11	Create an XSLT stylesheet to transform one employee's XML record into a structured and readable HTML format, showing details like name, department, and contact info.	2	24CDS361.4
12	Design a "Contact Us" form for a logistics company website. Use jQuery's serialize() method to capture all form fields as a single string for submission or preview.	2	24CDS361.4
PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**			

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1.Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web How to program", 5th Edition, Pearson Education/PHI, 2012, ISBN-13 : 978-0130161437

2. Erik Bruchez, Danny Ayers, Eric Van Der Vlist, "Professional Web 2.0 Programming",1stEdition, Wiley India Pvt. Ltd, 2014, ISBN-13 : 978-0470087886

3. Randal L. Schwartz, brian d foy, Tom Phoenix, "Learning Perl " 6th Edition, Released June 2011,Publisher(s): O'Reilly Media, Inc., ISBN: 9781449303587

R PROGRAMMING FOR DATA SCIENCE

Course Code	**24CDS362**	**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:

24CDS362.1	Implement the fundamental concepts of R programming.
24CDS362.2	Examine the built in and user defined functions in R.
24CDS362.3	Analyze the Matrix, Array and Factor Concepts
24CDS362.4	Examine Lists and Data Frames in R.
24CDS362.5	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	PSO1	PSO2
24CDS362.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS362.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS362.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS362.4	-	-	3	3	3	-	-	-	-	-	-	3	3
24CDS362.5	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Programming fundamentals, variables, arrays, control structures** • **R Studio installed**	2	NA
	PART-A		
1	Perform the following operation in R Console 1. Creating variables and performing basic arithmetic operations 2. Logical operations	2	24CDS362.1
2	Write a program in R to print first 100 prime numbers	2	24CDS362.1
3	Write a function in R to count the number of words in a string	2	24CDS362.2
4	Implement following operations in R 1. Elementwise arithmetic operations on arrays and matrices 2. Matrix multiplication	2	24CDS362.3

	3. Dot product 4. Transpose and reshaping of N-D arrays		
5	Write a program in R to implement a neural network with one hidden layer for binary classification. Train and test the netwok using titanic dataset	2	24CDS362.3
6	Write a function in R to threshold an array of probability values using a threshold value. The function should return indices of elements greater than a given threshold	2	24CDS362.3
PART-B			
7	Write a program in R to demonstrate the use of factors () to analyze Grades of students. Sample grades of 10 students are given as ("A", "B", "A", "C", "B", "A", "C", "B", "B", "C"). Compute 1. Unique categories using levels () 2. Frequency of each categories using table () 3. Create an ordered factor and print the summary 4. Use bar plot to visualize	2	24CDS362.4
8	Write an R program to create a list and perform various operations	2	24CDS362.4
9	Implement a student score tracker using Vectors and Lists 1. Uses a vector to store student scores. 2. Uses a list to store student details (name, roll number, scores, average). Computes and displays each student's information.	2	24CDS362.4
10	Write an R program to create sample (Dummy) data in R and perform data manipulation with R. 1. Perform the various operations on data frames in R 2. Data Manipulation with dplyr package	2	24CDS362.4
11	Implement Histograms, Scatter plots, Box plot in R.	2	24CDS362.5
12	Study and implementation of Data Visualization with ggplot2	2	24CDS362.5

PART-C

Beyond Syllabus Virtual Lab Content

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

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1. *Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series, ISBN-13:978-1466569997*
2. *Michael J. Crawley, "Statistics: An Introduction using R", Second edition, Wiley,2015, ISBN-13: 978-1118941096 ISBN-10: 1118941098*

PROJECT MANAGEMENT WITH GIT

Course Code	**24CDS363**	**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:

24CDS363.1	Demonstrate the basic command of Git and manage branches in Git.
24CDS363.2	Apply the process of collaborating and working with remote repositories.
24CDS363.3	Inspect the advanced Git operations.
24CDS363.4	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	PSO1	PSO2
24CDS363.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS363.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS363.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS363.4	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Software development process** • **A command line interface** • **A text editor of your choice** • **A GitHub Account**	2	NA
	PART-A		
1	Initialize a new Git repository in a directory. Create a new file, add it to the staging area and commit the changes with an appropriate commit message.	2	24CDS363.1
2	Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."	2	24CDS363.1
3	Write the commands to stash your changes, switch branches, and then apply the stashed changes.	2	24CDS363.1
4	Clone a remote Git repository to your local machine.	2	24CDS363.2
5	Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.	2	24CDS363.2

6	Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.	2	24CDS363.2
	PART-B		
7	Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.	2	24CDS363.3
8	Write the command to cherry-pick a range of commits from "source-branch" to the current branch.	2	24CDS363.3
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	24CDS363.4
10	Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."	2	24CDS363.4
11	Write the command to display the last five commits in the repository's history.	2	24CDS363.4
12	Write the command to undo the changes introduced by the commit with the ID "abc123"	2	24CDS363.4

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	5	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05

L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**05**

Suggested Learning Resources:

Reference Books:

3. *Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc, ISBN-13:978-1492091196*
4. *Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://gitscm.com/book/en/v2 ISBN: 978-1484200773*

ADVANCED EXCEL FOR DATA ANALYTICS

Course Code	**24CDS364**	**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:

24CDS364.1	Understand the use of Excel spreadsheets and various basic data functions of Excel.
24CDS364.2	Demonstrate the operations related to Columns & Rows.
24CDS364.3	Demonstrate SPSS and its operations, representing data diagrammatically and graphically using MS-EXCEL and SPSS.
24CDS364.4	Compute absolute and relative measures of central tendency and dispersion, correlation and regression analysis using MS-EXCEL and SPSS.
24CDS364.5	Understand the concepts related to hypothesis, computation of large sample 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	PSO1	PSO2
24CDS364.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS364.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS364.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS364.4	-	-	3	3	3	-	-	-	-	-	-	3	3
24CDS364.4	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Microsoft Excel should be installed** • **Familiarity with spreadsheets and tabular data**	2	NA
	PART-A		
1	Create a sample excel sheet. Import some data and perform the following operations 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.	2	24CDS364.1
2	Create a sample excel sheet. Import some data and perform the following operations	2	24CDS364.2

	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.		
3	Create dummy data of Student Name and Marks. Use IF function to create a new column with values PASS/FAIL based on mark.	2	24CDS364.3
4	Create dummy data of Student Name and Marks. Use IF and the nested IF functions to perform conditional formatting of rows with marks greater than 80	2	24CDS364.3
5	Create dummy data of Student Name and Marks. Use VLOOKUP function to find the mark of given student.	2	24CDS364.4
6	Use the RANDBETWEEN function to simulate a dice roll. Generate 1000 sample data and compute the probability of each face.	2	24CDS364.4
PART-B			
7	Import a dataset into excel. Use filtering and sorting on various columns.	2	24CDS364.5
8	Use of Pivot tables with categorical as well as numerical data to create report	2	24CDS364.5
9	Import any appropriate dataset into Excell and plot the following charts 1. Scatter plot and line plot 2. Histogram 3. Pie Chart	2	24CDS364.5
10	Move between one Spreadsheet to another and copy and paste Data between Spreadsheets.	2	24CDS364.6
11	Apply the concept of Inserting & Deleting Spreadsheets and Renaming Spreadsheets.	2	24CDS364.6
12	Perform the following operation in a sample worksheet 1. Split the screen 2. Freeze panes	2	24CDS364.6

PART-C

Beyond Syllabus Virtual Lab Content

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

1. Take any raw, messy dataset. Clean the data using formulas and Excel tools.
   Tasks:
   - Remove duplicates
   - Convert text to columns
   - Trim white spaces (TRIM)
   - Standardize case (UPPER, PROPER)
   - Use IFERROR to handle missing or invalid data
   - Use Power Query for automated cleaning
2. Perform linear regression to analyze impact of Advertising on Sales on any dataset
   Tasks:
   - Enable **Data Analysis ToolPak**
   - Run regression using **Sales** as dependent variable
   - Interpret R^2, coefficients, p-values
   - Create a prediction model using the regression formula

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:

5. Data Analysis with Microsoft Excel Paperback – Import, 25 March 2003 by K. Berk (Author), Partrick Carey (Author), ISBN-10: 0534407145
6. Excel 2019 Bible, Michael Alexander, 1st edition, John Wiley & Sons Inc, ISBN: 9781119514787.

BIO INSPIRED DESIGN AND INNOVATION

Course Code	**24CDS365**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:

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

24CDS365.1	Apply the biomimetics principles for real life challenges
24CDS365.2	Investigate novel bioengineering initiatives by evaluating design and development principles
24CDS365.3	Apply the bio computing optimization through research and experiential learning.
24CDS365.4	Review 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	PSO1	PSO2
24CDS365.1	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS365.2	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS365.3	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS365.4	3	3	3	3	2	-	-	-	1	1	-	3	3

MODULE-1	**BIO-INSPIRED DESIGN AND ENGINEERING**	**24CDS365.1**	**3 Hours**

Bio-Inspired Engineering and design, History, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).

Self-study	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**	**24CDS365.2**	**3 Hours**

Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Bio- Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic, Wasp-Inspired Needle)

Case Study	Investigate Bio-Compatible and health care applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	**BIO SUSTAINABLE DEVELOPMENT**	**24CDS365.3, 24CDS365.4**	**3 Hours**

Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air purification, filtration), Dew water collection systems, water purification, desalination.

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**	**24CDS365.5**	**3 Hours**

No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm, 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**	**24CDS365.6**	**3 Hours**

Bioinspired innovations in– Automotive, Automation, Materials and Manufacturing, Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), Eco-restorations (Eco-friendly pesticide).

Self-study/ Case Study	Survey on Bio inspired Innovations, design, applications and case studies of the same.

/Applications	
Text Book	Text Book 2: 12.1 to 12.10
CIE Assessment Pattern (50 Marks – Theory) –	

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) 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

Wann D, "Bio Logic: Designing with nature to protect the environment", Wiley Publisher, 1994

Web links and Video Lectures (e-Resources) :

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://biodesign.berkeley.edu/bioinspired-design-course/
- 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

- Bio Materials printing using 3D Printing
- Flipped classroom
- Organizing Group wise discussions on sub topics

Student presentations

DESIGN THINKING AND FABRICATION

Course Code	**24DTK37**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:

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

24DTK37.1	Identify innovation opportunities through real-world problem analysis and observation.
24DTK37.2	Propose a product or service idea using technical knowledge and feasibility insights.
24DTK37.3	Demonstrate empathy and creative thinking in the ideation and concept generation stages.
24DTK37.4	Design, prototype, and test functional models using appropriate tools and fabrication

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24DTK37.1	3	-	-	-	-	-	-	-	-	-	-		
24DTK37.2	3	3	2	-	-	-	-	-	-	-	-		
24DTK37.3	3	3	2	-	-	-	-	-	-	-	-		
24DTK37.4	3	3	2	1	2	-	-	-	-	-	2		

MODULE-1	**INTRODUCTION TO DESIGN THINKING**	**24DTK37.1 24DTK37.3**	**3 Hours**

Definition, origin, and key features of Design Thinking. Role of a Design Thinker in organisations. Core principles and stages of the Design Thinking process. Collaborative design thinking with examples of MVPS or prototyping

Self-study	Smart Agricultural Monitoring System
Text Book:	Text Book 1: 2.1,2.2,2.4,2.5,2.6,2.7 Text Book 2: Page No. 1-90

MODULE-2	**DESIGN THINKING METHODOLOGY**	**24DTK37.3**	**3 Hours**

Design Thinking Methodology: The 5 Stages of the Design Thinking Process- Empathise, define (the problem), Ideate, Prototype, and Test.

Self-study	Autonomous Drone for Aerial Surveillance
Text Book	Text Book 1:5.1,5.2,5.3 Text Book 2: Page No.100-124

MODULE-3	**TOOLS FOR DESIGN THINKING**	**24DTK37.1**	**3 Hours**

Ideation tools & exercises. Sample Design Challenge, Introduction to the Design Challenge Themes, Storytelling and Tools for Innovation.

Self-study	Smart Home Automation System

Text Book	Text Book 1:4.1,4.2,4.6,4.8,6.1,6.2,6.3 Text Book 2: Page No.125-138		
MODULE-4	**EMPATHY MAPS**	**24DTK37.3**	**3 Hours**
Empathise-Understand customers, Empathy Maps, Empathise-Step into customers' shoes, Customer Journey Maps, Define- Analysis & Drawing Inferences from Research.			
Self-study	Custom Drone with Payload Integration for Search and Rescue		
Text Book	Text Book 1: 9.1,9.2,9.3,10.1,10.2,10.3,10.4 Text Book 2:Page No.139-146		
MODULE-5	**DESIGN CHALLENGE AND PROTOTYPING**	**24DTK37.2 24DTK37.4**	**3 Hours**
The Design Challenge: Define the Design Challenge, Prototyping & Iteration- Feasibility Study, Testing, Documentation, and the Pitching.			
Self-study	Automated PCB Inspection System		
Text Book	Text Book 1:3.1,3.2 Text Book 2: Page No.147 and 189		

CIE Assessment Pattern (50 Marks – Theory)

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

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) Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking. ISBN-13: 978-1790435371
2) John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013. ISBN-13: 978-1111645823

Reference Books:

1) Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009. ISBN-13: 978-1422177808
2) Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve - Apply", Springer, 2011, ISBN-13: 978-3-642-13756-3
3) Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011. 48 , ISBN-13: 978-0495668145
4) Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author), ISBN-13: 978-0231163569

Web links and Video Lectures (e-Resources)

- https://www.ibm.com/design/thinking/
- https://www.ideou.com/pages/design-thinking

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

- Ergonomic Kitchen Tool Handle: Reverse Engineering and Redesign
- Customizable Modular Furniture System: From Concept to Prototype
- Rapid PCB Prototyping for Bluetooth Applications
- CNC Milling for Custom Circuit Board Fabrication
- Smart Motion Detection System Using Microprocessor
- IoT-Based Smart Home Automation System Using Microprocessor
- Design and Fabrication of Rotary Milling Fixture
- Design and Fabrication of Milling Vise Attachment on Lathe Machine
- AI-Driven Drone for Search and Rescue Operations
- Autonomous Drone for Wildfire Detection and Monitoring
- Drone-Based Delivery System for Emergency Medical Supplies

NATIONAL SERVICE SCHEME

Course Code	**24NSS30**	**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:

24NSS30.1	Understand the importance of his / her responsibilities towards society.
24NSS30.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSS30.3	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.
24NSS30.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24NSS30.1	-	-	-	-	-	3	3	2	-	-	1
24NSS30.2	-	-	-	-	-	3	3	2	-	-	1
24NSS30.3	-	-	-	-	-	3	3	2	-	-	1
24NSS30.4	-	-	-	-	-	3	3	2	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3RD 24NSS30	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.	24NSS30.1, 24NSS30.2, 24NSS30.3, 24NSS30.4	30 HRS
4TH 24NSS40	4. Water conservation techniques – Role of different stakeholders–Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach forimplementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	24NSS40.1, 24NSS40.2, 24NSS40.3, 24NSS40.4	30 HRS
5TH 24NSS50	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS
6TH	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs).	24NSS60.1, 24NSS60.2,	

24NSS60	**11.** Govt. school Rejuvenation and helping them to achieve good infrastructure.	24NSS60.3, 24NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

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

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

Suggested Learning Resources:
Reference Books:

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

Pre-requisites to take this Course:

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

Pedagogy:

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

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1
    - Commencement of activity and its progress - PHASE – 2

- Execution of Activity
- Case study-based Assessment, Individual performance
- Sector/ Team wise study and its consolidation
- Video based seminar for 10 minutes by each student at the end of semester with Report.

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

			campus			
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/properconsultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India.For e.g. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

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

PHYSICAL EDUCATION AND SPORTS

Course Code	**24PED30**	**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:

24PED30.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PED30.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PED30.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PED30.4	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
24PED30.1	-	-	-	-	-	2	-	3	3	-	-	2
24PED30.2	-	-	-	-	-	2	-	3	3	-	-	2
24PED30.3	-	-	-	-	-	2	-	3	3	-	-	2
24PED30.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
3RD 24PED30	**Module 1: Orientation** A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.	24PED30.1, 24PED30.2	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	24PED30.2, 24PED30.3	15 HRS
	Module 3: Recreational Activities A. Postural deformities.	24PED30.3, 24PED30.4	10 HRS

	B. Stress management. C. Aerobics. D. Traditional Games.		
4TH 24PED40	**Module 1: Ethics and Moral Values** A. Ethics in Sports B. Moral Values in Sports and Games	24PED40.1, 24PED40.2	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.	24PED40.3	20 HRS
	Module 3: Role of Organization and administration	24PED40.4	5 HRS
5TH 24PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	24PED50.1, 24PED50.2, 24PED50.3, 24PED50.4	Total 30 Hrs./ Semester 2Hrs/week
6TH 24PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs:	24PED60.1,	Total 30 Hrs./

	• Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. A. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials	24PED60.2, 24PED60.3, 24PED60.4	Semester 2Hrs/week

CIE Assessment Pattern (50 Marks – Practical) –

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

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15

Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	**50**

Suggested Learning Resources:

Reference Books:

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

YOGA

Course	**24YOG30**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24YOG30.1	Understanding the origin, history, aim and objectives of Yoga
24YOG30.2	Become familiar with an authentic foundation of Yogic practices
24YOG30.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
24YOG30.4	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
24YOG30.1	-	-	-	-	-	3	-	-	-	-	1
24YOG30.2	-	-	-	-	-	3	-	-	-	-	1
24YOG30.3	-	-	-	-	-	3	-	-	-	-	1
24YOG30.4	-	-	-	-	-	3	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd 24YOG30	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and benefit Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	24YOG30.1, 24YOG30.2, 24YOG30.3, 24YOG30.4	Total 32 Hrs./ Semester 2 Hrs/week
4TH 24YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	24YOG40.1, 24YOG40.2, 24YOG40.3, 24YOG40.4	Total 32 Hrs./ Semester 2 Hrs/week

5TH 24YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	24YOG50.1, 24YOG50.2, 24YOG50.3, 24YOG50.4	Total 32 Hrs./ Semester 2 Hrs/week
6TH 24YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	24YOG60.1, 24YOG60.2, 24YOG60.3, 24YOG60.4	Total 32 Hrs./ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

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

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

Suggested Learning Resources:

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

IV
Semester

DISCRETE MATHEMATICS AND GRAPH THEORY

(Common to AIML, CSE, CDS & ISE)

Course Code	**24MAC41**	**CIE Marks**	**50**
L:T:P:S	**2:1:0:0**	**SEE Marks**	**50**
Hrs. / Week	**4**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course outcomes:

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

24MAC41.1	Justify the arguments with propositional and predicate logic and from truth tables.
24MAC41.2	Solve the engineering problems involving relations and functions.
24MAC41.3	Illustrate the principle of inclusion and exclusion.
24MAC41.4	Analyze the computer science problems by using graph theory techniques.
24MAC41.5	Understand and analyze graph properties related to connectedness and planarity.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
24MAC41.1	3	3	-	-	-	-	-	-	-	-	-	-
24MAC41.2	3	3	-	-	-	-	-	-	-	-	-	-
24MAC41.3	3	3	-	-	-	-	-	-	-	-	-	-
24MAC41.4	3	3	-	-	-	-	-	-	-	-	-	-
24MAC41.5	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**MATHEMATICAL LOGIC**	**24MAC41.1**	**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, Quantifiers.

Text Book	Text Book 1: 2.1, 2.2, 2.3. 2.4, 2.5.

MODULE-2	**RELATIONS AND FUNCTIONS**	**24MAC41.2**	**8 Hours**

Cartesian Products and Relations, One-to-One and onto functions. The Pigeon hole Principle, Function Composition an Inverse Functions. Properties of Relations, Equivalence Relations and Partitions. Partial orders-Hasse diagrams.

Text Book	Text Book 1: 5.1, 5.2, 5.3, 5.5, 5.6, 7.1, 7.3, 7.4.

MODULE-3	**THE PRINCIPLE OF INCLUSION AND EXCLUSION**	**24MAC41.3**	**8 Hours**

The principle of Inclusion and Exclusion, Generalizations of the principle, Derangements-Nothing is in its Right Place, Rook Polynomials. Recurrence relations: First order linear recurrence relation, the second order linear homogeneous recurrence relation with constant coefficients.

Text Book	Text Book 1: 8.1, 8.2, 8.3, 8.4, 10.1, 10.2.		
MODULE-4	**GRAPH THEORY**	**24MAC41.4**	**8 Hours**
Introduction, Basic definition, Application of graphs, finite, infinite and bipartite graphs, incidence and degree, isolated vertex, pendant vertex and null graph. Isomorphism of graphs. Introduction to sub-graphs, walks, paths, circuits and cycles.			
Text Book	Text Book 1: 11.1, 11.2, 11.3, 11.4, Text Book 2: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9.		
MODULE-5	**CONNECTIVITY AND PLANARITY**	**24MAC41.5**	**8 Hours**
Eulers graphs, Hamiltonian paths, circuits and cycles, Rooted and Binary trees, Huffman code, Directed graphs, Vertex connectivity, edge connectivity, cut set and cut vertices, fundamental circuits. Planar graphs, Dual of planar graphs, Different representation of a planar graph.			
Text Book	Text Book 1: 11.5, 12.1, 12.2, 12.3, Text Book 2: 3.1, 3.5, 4.1, 4.2, 4.3, 4.4, 4.5, 5.2, 5.4, 5.6, 5.7.		

List of Tutorial Contents

Sl. No.	Contents	COs
1.	Uses of Propositional logic-problems	24MAC41.1
2.	Boolean algebra-problems	24MAC41.1
3.	Uses of relations and functions in Cryptography-problems	24MAC41.2
4.	Partial orders-Hasse diagrams	24MAC41.2
5.	Principle of Inclusion and Exclusion	24MAC41.3
6.	Rook Polynomials	24MAC41.3
7.	Bipartite graphs	24MAC41.4
8.	Isomorphism of graphs	24MAC41.4
9.	Huffman Tree and Huffman code	24MAC41.5
10.	Representations of a planar graph	24MAC41.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Theory Tests	AAT1	AAT2
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	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**	**5**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**15**
L5	**Evaluate**	**10**
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)
  - Problem solving Approach
  - Organizing Group wise discussions on related topics

Seminars

OBJECT ORIENTED PROGRAMMING WITH JAVA

Course Code	**24CSK42**	**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:

24CSK42.1	Model the real-world entities using Object Oriented Programming concepts.
24CSK42.2	Identify the importance of inheritance and interface concepts and apply to model relationships
24CSK42.3	Analyze the importance of exception handling and string handling operations
24CSK42.4	Apply the concept of Multithreading in concurrent programming
24CSK42.5	Develop applications using collections framework for managing user defined types
24CSK42.6	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	PSO1	PSO2
24CSK42.1	3	3	3	3	2	-	-	-	-	-	-	2	3
24CSK42.2	3	3	3	3	2	-	-	-	-	-	-	2	3
24CSK42.3	3	3	3	3	2	-	-	-	-	-	-	2	3
24CSK42.4	3	3	3	3	2	-	-	-	-	-	-	2	3
24CSK42.5	3	3	3	3	2	-	-	-	-	-	-	2	3
24CSK42.6	3	3	3	3	2	-	-	-	-	-	-	2	3

MODULE-1	**INTRODUCTION TO JAVA**	**24CSK42.1**	**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, Object Oriented concepts, Classes, Objects and Methods, Access specifiers, Method Overloading, Constructor, Implicit this.

Text Book	Text Book 1: Part 1 Chapter 1 to 7

MODULE-2	**INHERITANCE AND INTERFACING**	**24CSK42.2**	**8 Hours**

Inheritance, Method Overriding, Annotations, Static members, Inner Classes, Abstract Classes, Final members and classes, The Object Class, Interfaces, Package Fundamentals, Reflections

Text Book	Text Book 1: Part 1 Chapter 8 ,9,12		
MODULE-3	**STRING MANIPULATION AND FILE HANDLING**	**24CSK42.3, 24CSK42.4**	**8 Hours**
String Constructors, Length Operations, Character Extraction, Comparison, Searching, Modifying, String Buffer, StringBuilder, Basic file I/O: File Input Stream, File Output Stream, File Reader, File Writer			
Text Book	Text Book 1: Part 2 Chapter 16, Part 1 Chapter 13		
MODULE-4	**EXCEPTION HANDLING AND MULTI-THREADING**	**24CSK42.5**	**8 Hours**
Exception handling: Fundamentals, Types, Using try, catch, throw, throws, finally, multiple catch, User Defined Exceptions, Thread Concept, Java Thread Model, the main method, Creating Threads, Daemon Threads, Thread Pool, Thread Priorities, Synchronization, join.			
Text Book	Text Book 1: Part 1 Chapter 10, 11		
MODULE-5	**COLLECTION FRAMEWORK**	**24CSK42.6**	**8 Hours**
Collections Overview, Collection Interfaces, Set, List, Map, Queue, Collection Classes, Generics, Type Wrappers, accessing a collection using an Iterator, Sorting collections, equals ().			
Text Book	Text Book 1: Part 1 Chapter 14		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution			
		Test (s)	AAT1	AAT2	AAT3
		25	7.5	7.5	10
L1	Remember	-	-	-	-
L2	Understand	5	-	-	-
L3	Apply	10	5	-	5
L4	Analyze	5	2.5	2.5	5
L5	Evaluate	5	-	5	-
L6	Create	-	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Herbert Schildt & Danny Coward, Java: The Complete Reference, 13th Edition, McGraw Hill, 2024. ISBN 978-1265058432

Reference Books:

1. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education,2018
2. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & sons, 2019 (Reprint).
3. Y. Daniel Liang, "Introduction to JAVA Programming", 10th Edition, Pearson Education.
4. R. A. Johnson, "Java Programming and Object-Oriented Application Development", Cengage Learning, 2020 (Reprint)

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=bm0OyhwFDuY&list=PLsyeobzWxl7pe_IiTfNyr55kwJPWbgxB5
- https://www.youtube.com/watch?v=CFD9EFcNZTQ
- https://www.youtube.com/watch?v=r59xYe3Vyks&list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-Al

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

- Hands-on with coding platforms like Codetantra.

OBJECT ORIENTED PROGRAMMING WITH JAVA LAB

Course Code	**24CSLK42**	**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:

24CSLK42.1	Design solutions for real world problems using Object Oriented Programming concepts.
24CSLK42.2	Develop applications using String concept in Java.
24CSLK42.3	Apply the concept of Multithreading and exception handling in java programming
24CSLK42.4	Model and manage the application data using 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	PSO1	PSO2
24CSLK42.1	3	3	3	3	2	-	-	-	-	-	2		
24CSLK42.2	3	3	3	3	2	-	-	-	-	-	2		
24CSLK42.3	3	3	3	3	2	-	-	-	-	-	2		
24CSLK42.4	3	3	3	3	2	-	-	-	-	-	2		

Pgm. No.	List of Programs **Note: Student must attempt one question from PART A and PART B each during SEE Exam.**	Hours	COs
	Prerequisite Programs / Demo		
	Expected Prior Knowledge and Skills: Problem solving skill, Basic programming concepts	1	NA
	PART-A		
1a.	Design and develop a Java program for the following task: 1. **Define a class** named Book with four attributes: • title (String) • author (String) • isbn (int) • price (double) 2. **Provide a constructor** that initializes all four attributes when a Book object is created.	2	24CSLK42.1

	3. **In the main method, declare an array for five Book objects, instantiate each element by calling the Book constructor, and then print every book's details in a clear, well-formatted manner.** **Print the details** of each Book object in a clear, well formatted manner.		
2a.	A courier company must calculate the volume of shipping cartons that come in different shapes and require optional padding. Design and develop a Java class Box and a driver program that meet the following requirements: **Constructor Overloading** • Box() → creates a default carton of 1 cm × 1 cm × 1 cm. • Box(double side) → creates a cube-shaped carton whose three edges are all side cm. • Box(double length, double breadth, double height) → creates a rectangular carton with the given dimensions in centimetres. **Method Overloading (all named volume)** • double volume() → returns the carton's raw volume in cm^3. • double volume(double scaleFactor) → returns the volume after being multiplied by scaleFactor (e.g., 1.05 for 5 % padding). • static double volume(double l, double b, double h) → **static helper** that calculates the volume of any block without creating a Box object. In a driver class (BoxDemo): • Construct one object with each constructor. • Display the dimensions of every box. • Demonstrate each overloaded volume method, clearly labelling the output.	2	24CSLK42.1
3a.	Design and implement a Java program to demonstrate both **multilevel inheritance** and **hierarchical inheritance**. 1. **Create a Class** Person o **Attributes** – String name, int age o **Methods** ▪ void inputDetails()– read name and age from the keyboard (use a Scanner object). ▪ void showDetails() – print name and age in a tidy format. 2. **Class** Employee (extends Person – first level of multilevel inheritance) o **Additional Attribute** – int empId o **Methods** ▪ double calculateAnnualSalary(double basicSalary)– return basicSalary * number of months in a year ▪ void showEmployeeInfo(double basicSalary) – display empId and the annual salary computed by calculateAnnualSalary. 3. **Class** Manager (extends Employee – second level of multilevel inheritance; first branch of hierarchical inheritance) o **Additional Attribute** – String department o **Methods** ▪ double totalCompensation(double basicSalary, double incentive)– return calculateAnnualSalary(basicSalary) + incentive. ▪ void showManagerInfo(double basicSalary, double incentive) – display department and the total compensation. 4. **Class** Clerk (extends Employee – second level of multilevel inheritance; second branch of hierarchical inheritance)	2	24CSLK42.1

	○ **Additional Attribute** – int typingSpeed (words per minute) ○ **Methods** ▪ int dailyWordCount(int hours)– return typingSpeed * 60 * hours. ▪ void showClerkInfo(int hours) – display typingSpeed and the daily word count for the given hours. Driver Program (CompanyDemo) 1. Create **at least two** Manager **objects and two** Clerk **objects**, gathering data from the user via the methods listed above or via constructors. 2. Store all objects in an array 3. For each object, call the class-specific methods (showDetails(), showEmployeeInfo(), showManagerInfo(), showClerkInfo(), etc.) to display the information produced by your calculations.		
4a.	Write a Java program that models different kinds of musical instruments and shows runtime (dynamic) polymorphism through method overriding. 1. **Base class** ○ Create an abstract class Instrument containing a method void playNote(). 2. **Subclasses (hierarchical inheritance)** ○ Piano overrides playNote() to print "Piano: C-E-G chord". ○ Guitar overrides playNote() to print "Guitar: Strum on E minor". ○ Flute overrides playNote() to print "Flute: Sustained A note". 3. **Driver code** (OrchestraDemo) ○ Declare an Instrument[] array that holds one object of each subclass. ○ Iterate through the array and invoke playNote() on every element. ○ Show that the correct subclass version executes at runtime, proving dynamic dispatch.	2	24CSLK42.1
5a.	Design and implement a Java program to calculate the **area** and **perimeter** of the geometric shapes, **Circle**, **Rectangle**, and **Right-Angled Triangle** using an **interface** and an **abstract class**. 1. Define an **interface** that declares methods for calculating area and perimeter. 2. Create an **abstract class** that implements the interface and contains a common attribute such as color. 3. Derive concrete classes for the shapes **Circle**, **Rectangle**, and **Right-Angled Triangle**, each implementing the logic to calculate area and perimeter. 4. In the main class, allow the user to input dimensions and color for each shape, store the objects in a collection, and display the area, perimeter, and color for each shape. The program should demonstrate the use of **abstraction**, **inheritance**, and **runtime polymorphism**.	2	24CSLK42.1
6a.	Create a class in Java called “Calculator” which contains the following: 1. A static method called powerInt(int num1,int num2) that accepts two integers and returns num1 to the power of num2 (num1 power num2). 2. A static method called powerInt(double num1,int num2) that accepts one double and one integer and returns num1 to the power of num2 (num1 power num2). 3. Call your method from another class without instantiating the class (i.e. call it like Calculator.powerInt(12,10) since your methods are defined to be static). Hint: Use Math.pow(double, double) to calculate the power.	2	24CSLK42.1

	PART-B		
1b.	Design and Develop a Java program to find the longest substring without repeating characters in a given String. Accept the String through Command Line argument.	2	24CSLK42.2
2b.	Design and develop a Java program that uses both StringBuffer manipulation and basic **file input/output**: 1. **Read** an initial line of text from a file named input.txt. The file must contain the single line NEW HORIZON. 2. Load that line into a StringBuffer. 3. **Append** the text " COLLEGE", **insert** the phrase "ENGINEERING " immediately after the first space character, and finally **delete** the word "World" if it exists. 4. After **each** of these three operations, print the current buffer content along with its capacity **both to the console and to a file named** output.txt (append mode so every step is recorded).	2	24CSLK42.2
3b.	Design and develop a Java program that takes the names and marks of three subjects for two students from the user, calculates the average marks for each student, and handles **Number Format Exception** in case the user enters non-integer values for the marks. The program should display an appropriate error message and prompt the user to re-enter valid integer values. • 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	24CSLK42.3
4b.	Design and implement a Java program to solve the classic Producer-Consumer problem with a fixed-size shared buffer. Program must include Producer threads that add items and Consumer threads that remove items. Crucially, producers should wait if the buffer is full, and consumers should wait if it's empty, ensuring proper synchronization using **synchronized, wait(), and notifyAll()**.	2	24CSLK42.3
5b.	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	24CSLK42.4
6b.	Write a Java program that creates a new **ArrayList<Integer>**, adds several exam marks, and then performs the following operations: 1. **Add all elements** of another List<Integer> to the original ArrayList. 2. **Copy** the ArrayList to a plain int[] array. 3. **Reverse** the contents of the ArrayList. 4. **Extract** a **sub-list** (e.g., marks from index 2 to index 5). 5. **Sort** the ArrayList in ascending order. 6. **Clone** the ArrayList into another ArrayList<Integer>.	2	24CSLK42.4
	PART-C **Self-Study Component - Virtual Lab Content**		

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

- https://java-iitd.vlabs.ac.in/exp/exceptions
- https://java-iitd.vlabs.ac.in/exp/threading
- https://java-iitd.vlabs.ac.in/exp/collections

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	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	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books

1) Herbert Schildt & Danny Coward, Java: The Complete Reference, 13th Edition, McGraw Hill, 2024. ISBN 978-1265058432
2) J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & sons,2019(Reprint).
3) Y. Daniel Liang, "Introduction to JAVA Programming", 10th Edition, Pearson Education.
4) R. A. Johnson, "Java Programming and Object-Oriented Application Development", Cengage Learning, 2017(Reprint)

OPERATING SYSTEMS

Course Code	**24CSK43**	**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:

24CSK43.1	Understand the concept of processes and services offered by an operating system.
24CSK43.2	Apply Inter-Process Communication mechanisms and delve into the intricacies of CPU scheduling algorithms.
24CSK43.3	Examine hardware and software solutions to the critical-section problem and evaluate multiple mechanisms for managing deadlock situations.
24CSK43.4	Assess various approaches to memory management.
24CSK43.5	Examine the organization of secondary storage management
24CSK43.6	Conduct Linux Operating System case study.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSK43.1	3	-	-	-	-	-	-	-	-	-	1	2	-
24CSK43.2	3	3	2	2	2	-	-	-	-	-	2	3	-
24CSK43.3	3	3	2	2	2	-	-	-	-	-	2	3	-
24CSK43.4	3	3	2	2	-	-	-	-	-	-	2	3	-
24CSK43.5	3	3	2	2	-	-	-	-	-	-	2	3	-
24CSK43.6	3	3	2	2	2	-	-	-	-	-	1	3	1

MODULE-1	**OPERATING SYSTEM CONCEPTS**	**24CSK43.1**	**8 Hours**

Basic Operating Systems: Definition, Operating System Structure, Operating System Operations- Dual-Mode.
System Structure –Operating System Services, System Calls – Types of Operating System Structure-Layered Structure, Microkernel's, Modules, Hybrid Systems – Mac OS X, iOS, Android,
Process - Process Concept, Process States, PCB, Scheduling Queues, Schedulers, Context Switch.

Case Study/ Self-study	Investigate the Challenges in designing the Linux operating system from different viewpoints.
Text Book	Text Book 1: Chapter 1-1.1,1.4, Chapter 2-2.1,2.3,2.8, Chapter 3-3.1 Text Book 2: Chapter 2 – 2.2, 2.3, 2.5, 2.6

MODULE-2	**PROCESS MANAGEMENT**	**24CSK43.2**	**8 Hours**

Process Operations –Operation on Process; Inter-Process Communication – Shared Memory System, Message Passing System, Pipes and Sockets. **CPU Scheduling:** Basic Concepts, CPU- I/O Burst Cycle; CPU Scheduler – Pre-emptive Scheduling, Dispatcher; Scheduling Criteria; Scheduling Algorithms – FCFS, SJF, Round-Robin, Priority. **Multithread Programming**- Overview, Threading models and Threading issues			
Case Study/ Self-study	Investigate the various scheduling algorithms used in Linux operating systems. Various Thread library implementation.		
Text Book	Text Book 1: Chapter 3-3.2-3.6 Chapter 4- 4.1,4.2,4.3,4.4,4.6 Chapter 5-5.1-5.3 Text Book 2: Chapter 3: 3.1- 3.3		
MODULE-3	**PROCESS SYNCHRONIZATION AND CONCURRENCY**	**24CSK43.3**	**8 Hours**
Process Synchronization: Background; The Critical Section Problem; Peterson's Solution; Synchronization Hardware; Mutex Locks; Semaphores – Semaphore Usage, Semaphore Implementation, Deadlock and Starvation; Classical Problems of Synchronization – The Reader-Writer Problem, Dining-Philosopher Problem. **Deadlocks:** System Model; Deadlock Characterization – Necessary Conditions, Resource-Allocation Graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery.			
Case Study/ Self Study	Explore the need for synchronization in various Linux kernel data structures.		
Text Book	Text Book 1: Chapter 6-561-6.6, Chapter 7-7.1, Chapter 8-8.1-8.8		
MODULE-4	**MEMORY MANAGEMENT**	**24CSK43.4**	**8 Hours**
Memory Management – Swapping, Logical versus Physical Address Space, Contiguous Allocation, Paging - Basic Method, Hardware Support, Protection; Structure of Page Table-Hierarchical, Segmentation – Basic Method, Segmentation Hardware. **Virtual Memory**: Demand Paging; Page Replacement – Basics, Algorithms - FIFO, Optimal, LRU, Thrashing – Causes of Thrashing.			
Case Study/ Application	Scrutinize the Different types of Optimization techniques in managing virtual memory		
Text Book	Text Book 1: Chapter 9: 9.1 – 9.5 Chapter 10: 10.1, 10.2, 10.4, 10.6		
MODULE-5	**FILE SYSTEM MANAGEMENT**	**24CSK43.5, 24CSK43.6**	**8 Hours**
File-System Interface: File Structure, Access methods – Sequential Access, Direct Access, Other Access Methods Implementation: Directory Implementation – Linear List, Hash Table, Allocation Methods – Contiguous Allocation, Linked Allocation, Indexed Allocation. **Mass Storage Structures:** Overview, Disk Structure, Disk Scheduling –FCFS, SSTF, SCAN, CSCAN, LOOK. **Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.			
Case Study/ Application	For developing two programs that need to share data in real time without using files or databases, specify which IPC mechanism is available in Linux, and which would be most efficient for real-time communication between processes.		
Text Book	Text Book 1: Chapter 14:14.1,14.3,14.4,14.5 Chapter 20: 20.1-20.9 Text Book 2: 2.2		

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 10th Edition, 2018, ISBN: 978-1-118-06333-0.
2. W. Richard Stevens, UNIX Network Programming: Addison-Wesley, 1st Edition, ISBN-13: 978-0130810816

Reference Books:

1. Terrence Chan, Unix System Programming Using C++: Prentice Hall PTR, 1st Edition, ISBN-10: 0-13-3315622 / ISBN-13: 978-0133315622
2. W. Richard Stevens and Stephen A. Rago: Advanced Programming in the /UNIX Environment: Addison-Wesley, 2nd Edition, ISBN: 0321637739 / 978-0321637734
3. Brian W. Kernighan and Rob Pike: The UNIX Programming Environment: Prentice-Hall, 1st Edition, 0-13-937681-X/ 0-13-937699-2
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach, 3rd Edition, McGraw- Hill, ISBN 978-0072957693, 2013.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc24_cs108/preview
- https://www.youtube.com/watch?v=mXw9ruZaxzQ

- https://www.coursera.org/courses?query=operating%20system
- https://www.geeksforgeeks.org/operating-systems/operating-systems/
- https://www.tutorialspoint.com/operating_system/index.htm
- https://www.studytonight.com/operating-system/
- https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O

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

- Organizing Group wise discussions on issues
- Data Driven Case studies
- Cross Platform Comparative Learning

OPERATING SYSTEMS LAB

Course Code	**24CSLK43**	**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:

24CSLK43.1	Perform Linux basic and file related commands, System Calls and implement CPU Scheduling algorithms
24CSLK43.2	Devise solutions for process synchronization, deadlock avoidance, and prevention ina specified scenario
24CSLK43.3	Evaluate different methods of memory allocation and page replacement strategies.
24CSLK43.4	Implement disk scheduling algorithms based on a provided process description.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSLK43.1	3	3	3	3	3	-	-	-	-	-	3	3	-
24CSLK43.2	3	3	3	3	3	-	-	-	-	-	3	3	-
24CSLK43.3	3	3	3	3	3	-	-	-	-	-	3	3	-
24CSLK43.4	3	3	3	3	3	-	-	-	-	-	3	3	-

Prerequisite Experiments / Programs / Demo

24CSE24 24CSL24	Proficiency in programming languages like C is essential for operating system development since many OS components are typically written in C language.

Pgm. No.	List of Programs	Hours	COs
	PART A		
1a.	Implement a C program utilizing the following Linux commands and system calls: • opendir, readdir, closedir, fork, exec, create and terminate process and thread creation and termination. • File manipulation commands- creating a file, opening, copying, moving, renaming and deleting a file.	2	**24CSLK43.1**
2a.	Develop a program to model FCFS and non-preemptive SJF CPU	2	**24CSLK43.1**

	scheduling algorithm.		
3a.	Implement a C program by creating two unrelated processes for sharing the resource for demonstrating Shared Memory concept.	2	**24CSLK43.2**
4a.	Implement a C program to depict the Dining Philosopher's problem concept.	2	**24CSLK43.2**
5a.	Implement a program to emulate first-fit and best fit contiguous memory allocation. And also simulate paging table implementation anddetermining the actual physical address in memory	2	**24CSLK43.3**
6a.	Implement a program for simulating the FCFS and SCAN disk schedulingalgorithm.	2	**24CSLK43.4**
	PART B		
1b.	Implement a C Program File handling utilities: • that takes one or more file/directory names as command line input and reports following information: File type, number Of links, time of last access, read, write and execute permissions, list all the files in a directory. • Check for following limits: No. of clock ticks, Max. no. of child processes, Max. path length, Max. no. of characters in a file name, Max. no. of open files/ process.	2	**24CSLK43.1**
2b.	Create a C program to simulate the Priority and round-robin scheduling algorithm	2	**24CSLK43.1**
3b.	Implement a C program to depict the Producer-Consumer problem using semaphores.	2	**24CSLK43.2**
4b.	Develop a program for simulating the Banker's Algorithm to prevent deadlock avoidance.	2	**24CSLK43.2**
5b.	Create a program to execute the FIFO and Optimal page replacement algorithm.	2	**24CSLK43.3**
6b.	Implement a program for simulating the SSTF and LOOK disk schedulingalgorithm.	2	**24CSLK43.4**

DATABASE MANAGEMENT SYSTEMS

Course Code	**24CSK44**	**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:

24CSK44.1	Describe DBMS architecture, components and database design.
24CSK44.2	Implement database schema for an application using RDBMS concepts.
24CSK44.3	Write SQL queries for tasks of various complexities.
24CSK44.4	Design an application program that uses a database system as the backend and the internal working of a DBMS including indexing and Hashing.
24CSK44.5	Understand the internal working of a DBMS including transaction processing, concurrency control and recovery mechanisms.
24CSK44.6	Demonstrate modern database techniques including NoSQL systems for efficient data storage and retrieval.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSK44.1	3	3	3	2	-	-	-	-	-	-	1	-	-
24CSK44.2	3	3	3	2	-	-	-	-	-	-	1	-	-
24CSK44.3	3	3	3	2	-	-	-	-	-	-	1	-	-
24CSK44.4	3	3	3	2	-	-	-	-	-	-	1	-	-
24CSK44.5	3	3	3	2	-	-	-	-	-	-	1	-	-
24CSK44.6	3	3	3	2	-	-	-	-	-	-	1	-	-

MODULE-1	**DATABASE FUNDAMENTALS AND DATABASE DESIGN**	**22CSK44.1, 22CSK44.2**	**8 Hours**

Database Concepts: Definitions, Characteristics, Advantages of DBMS, Three-schema architecture, Data Abstraction & Independence, DBMS Components: Database Designers, Administrators, Users.
Entity-Relationship Model: Entity types, attributes, keys (super key, primary, candidate), Relationship types, structural constraints, weak entities, Reduction of ER schema to relational schema, Relational Model Concepts: Schema, Tuples, Domains, Keys, Integrity Constraints: Entity, Referential.

Self-study	Explore different real-world databases (e.g., railway reservation systems, hospital management systems) and identify the advantages of DBMS over traditional file systems.
Text Book	Text Book 1: 1.1,1.2, 1.3, 1.4, 1.6, 2.2, 2.4, 3.3, 3.4, 3.5, 5.1, 5.2

MODULE-2	RELATIONAL DATABASES AND SQL	24CSK44.3	8 Hours
Relational Algebra: Select, Project, Join, Union, Intersection, Difference, Rename, Division. **SQL Basics:** DDL: Create, Drop, Alter, Truncate; DML: Insert, Delete, Update; SQL Clauses: Where, Order By, Group By; Constraints: Not Null, Unique, Primary, Foreign Key; Aggregate functions: SUM, AVG, COUNT, MIN, MAX.			
Case Study	Consider three related tables representing entities and their associations. Design relational algebra queries to: Retrieve records that meet specific conditions. Identify records not associated with certain data (using difference). Write SQL statements to: Create tables and define their structures (DDL). Insert sample data (DML). Retrieve and summarize data using SELECT with various clauses (WHERE, GROUP BY, ORDER BY).		
Text Book	Text Book 1: 8.1, 8.2, 8.3, 6.1, 6.2, 6.3, 6.4		
MODULE-3	**QUERY PROCESSING & INDEXING**	**24CSK44.4**	**8 Hours**
Advanced SQL: Union, Intersect and Except; Nested Queries; Correlated Queries; Joins; Introduction to Views; Triggers; Dynamic SQL, ODBC/JDBC. **Indexing:** Tree Structured Indexing: Indexed sequential access method, B+ Trees, Format of a node, Search, Insert, Delete, Duplicates, Hash based indexing: Static Hashing, Extendible Hashing, Linear Hashing			
Self-study	Explore different types of joins (inner, outer, left, right, natural) by creating simple tables and writing example queries to understand how results differ.		
Text Book	Text Book 2: 3.6, 5.3, 5.4, 5.6, 5.9, 5.10, 5.12, 9.1 - 9.7, 10.1 - 10.3		
MODULE-4	**NORMAL FORMS & TRANSACTION PROCESSING**	**24CSK44.5**	**8 Hours**
Normalization: Functional Dependencies; Normal Forms: 1NF, 2NF, 3NF, BCNF; **Transaction Management:** ACID Properties; Schedules: Recoverability, Serializability; Concurrency Control: 2PL-Two-Phase Locking, Time-stamp based & Optimistic Concurrency; Database Recovery concepts.			
Case Study	Start with a large unnormalized relation containing redundant and repeating groups. Identify all functional dependencies. Normalize the relation step by step to achieve 3NF or BCNF, clearly explaining the design decisions.		
Text Book	Text Book 1: 20.1, 20.3, 20.4, 20.5, 21.1, 21.2, 21.4, 22.1,		
MODULE-5	**NoSQL & MODERN DATABASE SYSTEMS**	**24CSK44.6**	**8 Hours**
NoSQL: Introduction to NoSQL: Need, Features, ACID vs BASE, CAP Theorem; Types: Key-Value, Document, Column, Graph. **Modern Database Systems:** Cassandra DB: Architecture, Data Centers and Racks, Gossip Protocol, Snitches vs Nodes, Replication, Read/Write Operations, Caching, Compaction, Tombstones. Mongo DB: Overview.			
Self-study	Compare different NoSQL database types: Key-Value, Document, Column, Graph, focusing on their data models and use cases.		
Text Book	Text Book 1: 24.1 - 24.6, Text Book 3: 6.1, 6.2, 6.3, 6.5, 6.7, 6.15,6.16, 6.17, 9.1, 9.2		

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems" , Pearson / Addison - Wesley, ISBN-0133970779 7th Edition 2021.
2. Raghu Ramakrishnan, "Database Management Systems", Third Edition, ISBN-0-07-246563-8 McGraw Hill, 2013.
3. Jeff Carpenter, Eben Hewitt, Cassandra: The Definitive Guide", O'Reilly Media, ISBN-10. 1491933666

Reference Books:

4. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, ISBN-13: 978-9390727506, Tata McGraw Hill, 2020.
5. Pramod J. Sadalage, Martin Fowler, "NoSQL Distilled", Pearson Education, ISBN-13. 9780321826626.

Web links and Video Lectures (e-Resources):

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

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

- Qualitative Assessment - Explore Live Database Application
- Case Study- Designing a relational database for any given scenario

DATABASE MANAGEMENT SYSTEMS LAB

Course Code	**24CSLK44**	**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:

24CSLK44.1	Apply the concepts of DDL, DML, data constraints to various relations.
24CSLK44.2	Analyze the concepts of joins to perform nested and correlated queries.
24CSLK44.3	Evaluate user-defined View and Trigger to the database of any given scenario.
24CSLK44.4	Examine NoSQL databases and execute CRUD (Create, Read, Update, and Delete) operations within the Cassandra database, MongoDB.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSLK44.1	3	3	3	3	3	-	-	-	1	1	2	-	-
24CSLK44.2	3	3	3	3	3	-	-	-	1	1	2	-	-
24CSLK44.3	3	3	3	3	3	-	-	-	1	1	2	-	-
24CSLK44.4	3	3	3	3	3	-	-	-	1	1	2	-	-

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs / Demo		
	• Demo on installation of SQL • Demo on installation of NoSQL	2	NA
	PART-A		
1a.	Demonstrate various DDL and DML commands to create, modify and manipulate data of a student database.	2	24CSLK44.1
2a.	Apply various data constraints such as primary key, foreign key, unique, not null, check, and default constraints while creating tables in a company database.	2	24CSLK44.1
3a.	Demonstrate the use of various SQL operators such as arithmetic, comparison, logical, and special operators on Hospital database.	2	24CSLK44.1
4a.	Apply aggregate functions along with GROUP BY, HAVING, and ORDER BY clauses on the given relation of a Library Database: BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Id, 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)	2	24CSLK44.2

	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.		
5a.	Analyze various types of joins (inner, outer, left, right, natural) on university database.	2	24CSLK44.2
6a.	Demonstrate nested queries and correlated subqueries 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) 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. 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	24CSLK44.2
	PART-B		
1b.	Create/replace single table view and multiple tables view, update and drop views for the given relations 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)	2	24CSLK44.3
2b.	Create and drop Triggers for various events such as insert, update and delete transactions.	2	24CSLK44.3

3b.	Develop a Java program to connect to a database using JDBC/ODBC and perform basic CRUD operations.	2	24CSLK44.3
4b.	Design and implement the relations using Cassandra NoSQL DB.	2	24CSLK44.4
5b.	Demonstrate creating and dropping a database in MongoDB.	2	24CSLK44.4
6b.	Create the collection in MongoDB.	2	24CSLK44.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. Develop a conceptual schema for Library Information System [http://vlabs.iitkgp.ernet.in/se/4/case_study]
2. Create and manipulate the database for Student Information System [http://vlabs.iitkgp.ernet.in/se/4/case_study]
3. Identify the possible entity sets, their attributes, and relationships from the given problem statements for E-R Modeling
   [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	-	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) Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”,7th Edition, July 2021
2) Jeff Carpenter, Eben Hewitt," Cassandra: The Definitive Guide" Publisher: O'Reilly Media, 2nd edition 2019, ISBN-13: 978-1491933664.

DATA ENGINEERING

Course Code	**24CDS451**	**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:

24CDS451.1	Understand. core data engineering concepts and technologies in Data Engineering.
24CDS451.2	Demonstrate the data modelling techniques and database design principles to create optimized database schemas for various applications.
24CDS451.3	Apply ETL processes to ensure data integrity and quality in data warehousing environments.
24CDS451.4	Examine data workflows using modern orchestration tools, ensuring data integration and quality across sources.
24CDS451.5	Understand the data governance fundamentals stewardship, ownership, and adherence to regulatory compliance such as GDPR, CCPA.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS451.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS451.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS451.3	3	3	3	-	-	-	-	-	-	-	-	3	3
24CDS451.4	2	2	3	-	-	-	-	-	-	-	-	3	3
24CDS451.5	3	3	3	-	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION TO DATA ENGINEERING**	**24CDS451.1**	**8 Hours**

Overview of Data Engineering, Role of a Data Engineer, Data Engineering vs. Data Science, Data Lifecycle Management, Data Architecture and Infrastructure, Introduction to Big Data, Characteristics of Big Data, Tools and Technologies in Data Engineering.

Self-study	Explore the latest trends and advancements shaping the field of data engineering, including technological innovations, industry practices, and evolving roles and responsibilities.
Text Book	Text Book 1: Chapter 1

MODULE-2	**DATA MODELLING AND DATABSE DESIGN**	**24CDS451.2**	**8 Hours**

Data Modelling Concepts, Dimensional Modelling, SQL and NoSQL Databases, Relational Database Management Systems (RDBMS), Document Stores, Key-Value Stores, Column-Family Stores, Graph Databases, Normalization and Denormalization, Indexing and Query Optimization.

Case Study	Design a dimensional model for an online retail company aiming to optimize its business operations and customer experience. Discuss the normalization and demoralization strategies, indexing techniques, and database technology choices, considering scalability and performance requirements. Evaluate the potential use of graph databases for analyzing customer-product relationships.

Text Book	Text Book 2: Chapter 4, 7		
MODULE-3	**DATA WAREHOUSING AND ETL PROCESS**	**24CDS451.3**	**8 Hours**
Data Warehousing Concepts, OLAP vs. OLTP, Data Warehouse Architecture, ETL (Extract, Transform, Load) Processes, ETL Tools and Techniques, Data Cleansing and Transformation, Data Lakes.			
Text Book	Text Book 3: Chapter 2, 3		
MODULE-4	**DATA INTEGRATION AND WORKFLOW MANAGEMENT**	**24CDS451.4**	**8 Hours**
Data Integration Techniques, APIs, Webhooks, Data Connectors, Workflow Orchestration, Apache Airflow, Luigi, Prefect, Data Quality Management, Data Profiling, Data Quality Dimension.			
Text Book	Text Book 2: Chapter 11		
MODULE-5	**DATA GOVERNING AND COMPLIANCE**	**24CDS451.5, 24CDS451.6**	**8 Hours**
Data Governance Fundamentals, principles of Data Governance, Data Stewardship and Ownership, Regulatory Compliance, GDPR, CCPA, and Other Data Privacy Regulations, Industry-specific Compliance Requirements (e.g., HIPAA for Healthcare), Data Security and Encryption, Encryption Techniques and Best Practices, Secure Data Transmission and Storage, Auditing and Monitoring, Ethical Considerations.			
Text Book	Text Book 3: Chapter 1		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	4	-	-
L2	Understand	4	-	-
L3	Apply	6	3	5
L4	Analyze	8	7	5
L5	Evaluate	3	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) Joe Reis, Matt Housley, Fundamentals of Data Engineering: Plan and Build Robust Data Systems (Grayscale Indian Edition) – _27 June 2022, ISBN-13, 978-9355421548.
2) Hector Garcia-Molina Jeffrey D. Ullman Jennifer Widom, DATABASE SYSTEMS, The Complete Book Second Edition ,2019, ISBN-13, 978-0131873254.
3) Mayank Malhotra, Ultimate Data Engineering with Databricks: Develop Scalable Data Pipelines Using Data Engineering's Core Tenets Such as Delta Tables, Ingestion, Transformation, Security, and Scalability – _Import, 14 February 2024, ISBN-13, 978-8196994785.

Reference Books:

1) Roberto Zagni, Data Engineering with dbt: A practical guide to building a cloud-based, pragmatic, and dependable data platform with SQL, Second Edition,2023, ISBN-13978-1803246284.

Web links and Vi

- https://www.datacamp.com/category/data-engineering
- https://www.udemy.com/topic/data-engineering/

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

➢ Contents related activities (Activity-based discussions)

➢ Organizing Group wise discussions on issues

PRINCIPLES OF CLOUD COMPUTING

Course Code	**24CDS452**	**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:

24CDS452.1	Understand the foundational principles of cloud computing and centralized computing systems.
24CDS452.2	Demonstrate the Cloud infrastructure of Google Cloud ad Amazon Cloud.
24CDS452.3	Identify private and hybrid cloud for organizations to execute customized applications.
24CDS452.4	Analyze authentication, confidentiality, and privacy issues in Cloud computing environment.
24CDS452.5	Analyze the financial and technological implications for selecting cloud computing platforms.
24CDS452.6	Categorize the security issues and emerging technologies of Cloud computing.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS452.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS452.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS452.3	3	3	3	-	-	-	-	-	-	-	-	3	3
24CDS452.4	2	2	3	-	-	-	-	-	-	-	-	3	3
24CDS452.5	3	3	3	-	-	-	-	-	-	-	-	3	3
24CDS452.6	3	3	3	-	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION OF CLOUD COMPUTING**	**24CDS452.1, 24CDS452.2**	**8 Hours**

Introduction and Fundamentals of Centralized and distributed Computing, Historical evolution of cloud computing, Introduction to Cloud Computing, Cloud Architecture, characteristics of cloud computing, Cloud issues and challenges, Overview of cloud computing concepts relevant to data science, Benefits of using cloud services for data science projects.

Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**CLOUD INFRASTRUCTURE AND SERVICE MODELS**	**24CDS452.1, 24CDS452.2**	**8 Hours**

Cloud Service models, Cloud Deployment Models, Data Pipelines in the Cloud, Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualizations- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs. Virtualization in Data Science Development Pipelines.

Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	CLOUD COMPUTING TOOLS AND SERVICES	24CDS452.3, 24CDS452.4	8 Hours
Cloud Storage Solutions, Cloud based data storage solutions, Data lakes and data warehouses in the cloud, Cloud providers, Networking in Cloud Computing, Serverless Computing, Cloud Development and Deployment, Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies – Anything as a service (XaaS).			
Text Book	Text Book 3: Chapter 2, 3		
MODULE-4	**CLOUD APPLICATIONS AND PROGRAMMING**	**24CDS452.3, 24CDS452.4**	**8 Hours**
Cloud Applications – Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services, Cloud Programming and Software Environments – Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment, Cloud-based Data Processing Frameworks			
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	**EMERGING TRENDS AND SECURITY IN CLOUD COMPUTING**	**24CDS452.5, 24CDS452.6**	**8 Hours**
Data Governance Fundamentals, principles of Data Governance, Data Stewardship and Ownership, Regulatory Compliance, GDPR, CCPA, and Other Data Privacy Regulations, Industry-specific Compliance Requirements (e.g., HIPAA for Healthcare), Data Security and Encryption, Encryption Techniques and Best Practices, Secure Data Transmission and Storage, Auditing and Monitoring, Ethical Considerations.			
Text Book	Text Book 3: Chapter 1		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	4	-	-
L2	Understand	4	-	-
L3	Apply	6	3	5
L4	Analyze	8	7	5
L5	Evaluate	3	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:

4) Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012. ISBN-13, 978-0123858801.
5) A.Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications 2014, ISBN-9788131776513

Reference Books:

2) Barrie Sosinsky, "Cloud Computing Bible" John Wiley & Sons, 2010, ISBN: 978-0-470-90356-8.
3) Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009, ISBN-9780596802769.
4) Rajkumar Buyya, James Broberg, Andrzej, "Cloud Computing: Principles and Paradigms", Wiley India Publications 2011, ISBN-13- 978-8126541256.

Web links and Video Lectures (e-Resources):

- NPTEL & MOOC courses titled Cloud computing
- https://nptel.ac.in/courses/106105167/

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

- Cloud Service Provider Visit
- Industry Collaboration Projects, Hackathon, or Innovation Challenge
- Internships or Summer Programs
- Analyze case studies of successful cloud implementations in various industries.
- Video demonstration of latest trends in cloud computing
- 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

BUSINESS ANALYTICS

Course Code	**24CDS453**	**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:

24CDS453.1	Understand fundamental business analytics concepts and techniques across various functions (marketing, finance, HR, operations)
24CDS453.2	Apply analytics methodology to prepare objectives, identify data requirements, collect and prepare data
24CDS453.3	Demonstrate proficiency in organizing and structuring data, including tabulation, ordering, and frequency distribution techniques
24CDS453.4	Understand basic time series techniques like decomposition and ARIMA models for effective analysis and forecasting.
24CDS453.5	Examine advanced time series models including STL, ARCH, and GARCH, gaining proficiency in diverse analytical approaches.
24CDS453.6	Apply advanced Excel functions and quantitative techniques in financial modeling for risk management, project finance, and ESG analysis, improving proficiency

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS453.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS453.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS453.3	3	3	3	-	-	-	-	-	-	-	-	3	3
24CDS453.4	2	2	3	-	-	-	-	-	-	-	-	3	3
24CDS453.5	3	3	3	-	-	-	-	-	-	-	-	3	3
24CDS453.6	3	3	3	-	-	-	-	-	-	-	-	3	3

MODULE-1	**INTRODUCTION TO BUSINESS ANALYTICS**	**24CDS453.1**	**8 Hours**

Concept of analytics, Types of Analytics, Application fields - Marketing Analytics, Finance Analytics, HR Analytics, Operation Analytics, organization and source of data, importance of data quality, dealing with missing or incomplete data, Role of Data Scientist in Business & Society

Case Study	A global e-commerce company wants to optimize its marketing strategies to increase customer acquisition, improve customer retention, and enhance overall sales performance. They decide to leverage marketing analytics to gain actionable insights from their data. 1. Identifying distinct customer segments based on behavior, demographics and purchasing pattern 2. Evaluate the effectiveness of marketing campaigns across different channels (e.g., email, social media, paid ads) and optimize allocation of marketing budget.
Text Book	Text Book 1: Chapter 1

MODULE-2	ANALYTICS METHODOLOGY	24CDS453.2	8 Hours
Introduction to Analytics Methodology, preparing objectives & identifying data requirements, Data Collection, Understanding data, Data preparation – Data Cleansing, Normalization, Data preparation, Data Blending, Data Modelling, Evaluation & feedback			
Text Book	Text Book 1: 2.1- 2.6		
MODULE-3	**EXPLORING DATA**	**24CDS453.3**	**8 Hours**
Storing and Structuring Data, Organization of Data, Tabulation, Ordering Data, Frequency Distribution, Grouped Frequency Distribution, Cumulative Frequency Distribution, Percentiles, Measures and evaluating variation in Data Values.			
Text Book	Text Book 3: 3.1-3.12		
MODULE-4	**TIME SERIES AND FORECASTING**	**24CDS453.4, 24CDS453.5**	**8 Hours**
Introduction to Time Series Analysis, Time Series Decomposition, Exponential Smoothing, Autoregressive Integrated Moving Average (ARIMA) Models, Seasonal Decomposition of Time Series (STL), Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) Models ,State Space Models			
Text Book	Text Book 2: Chapter 7		
MODULE-5	**FINANCIAL MODELING**	**24CDS453.6**	**8 Hours**
Advanced Excel Functions for Financial modelling, Project Finance Models, Financial modelling using Python and R, Quantitative Financial modelling, Financial modelling for Risk Management, Environmental, Social, and Governance (ESG) Financial modelling.			
Text Book	Text Book 3: Chapter 9 & 10		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	4	-	-
L2	Understand	4	-	-
L3	Apply	6	3	5
L4	Analyze	8	7	5
L5	Evaluate	3	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) Foster Provost and Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly Media, ISBN-13, 978-1449361327.
2) Arun Sukumar, Lucian TIPI, Jayne Revill, Applied Business Analytics.1st Edition,2016, ISBN-9788740313635.
3) Thomas H. Davenport and Jeanne G. Harris, Competing on Analytics: The New Science of Winning,2017, ISBN-13, 978-1422103326

Reference Books:

Web links and Vi

- https://www.udemy.com/courses/business/analytics-and-intelligence.
- https://www.coursera.org/specializations/business-analytics

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

- Contents related activities (Activity-based discussions)
- Organizing Group wise discussions on issues
- Seminars

COMPUTER GRAPHICS

Course Code	**24CDS454**	**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:

24CDS454.1	Explain the fundamentals of computer graphics, display devices, graphic input devices, software standards, and basic drawing primitives along with their scan conversion algorithms.
24CDS454.2	Apply line, circle, and polygon drawing algorithms, as well as fill area techniques, to develop basic 2D graphics using OpenGL functions and attributes.
24CDS454.3	Implement 2D geometric transformations, matrix representations, and viewing techniques using OpenGL for rendering interactive 2D scenes.
24CDS454.4	Demonstrate 3D geometric transformations, clipping algorithms, and color/illumination models to create realistic 3D graphics in OpenGL.
24CDS454.5	Construct 3D viewing pipelines, projection transformations, and viewport mappings, and integrate visible surface detection methods into 3D graphics applications.
24CDS454.6	Design and develop interactive 2D/3D computer graphics applications by integrating transformation algorithms, projection techniques, and OpenGL rendering functionalities.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS454.1	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS454.2	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS454.3	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS454.4	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS454.5	3	3	3	3	2	-	-	-	1	1	-	3	3
24CDS454.6	3	3	3	3	2	-	-	-	1	1	-	3	3

MODULE-1	**INTRODUCTION**	**24CDS454.1**	**8 Hours**

Basic of Computer Graphics, Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards, Points, lines, circles and ellipses as primitives, scan

conversion algorithms for primitives, Fill area primitives including scan-line polygon filling, inside-outside test, boundary and flood-fill, character generation, line attributes, area-fill attributes, character attributers.			
Text Book	Chapter 1: Sections 1-1 to 1-9, Chapter 2: Sections 2-1 to 2-3, 2-8, 2-9, Chapter 3: Sections 3-1 to 3-5, 3-9, 3-14 to 3-20.		
MODULE-2	**COMPUTER GRAPHICS AND OPENGL**	**24CDS454.2**	**8 Hours**
Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, graphics software. OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham‟s), circle generation algorithms (Bresenham‟s).			
Case Study	Design and Development of a 2D Interactive Drawing Application Using Computer Graphics Algorithms		
Text Book	Text-1:Chapter -1: 1-1 to 1-9, 2-1(page 39 to 41),2.8,2.9,3-1 to 3-5,3-9,3-20		
MODULE-3	**2D GEOMETRIC TRANSFORMATIONS AND 2D VIEWING**	**24CDS454.2, 24CDS454.3**	**8 Hours**
Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates. Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions.			
Case Study	Design Challenge: Interactive 2D Graphics Rendering with OpenGL		
Text Book	Chapter 3-14 to 3-16,4-9,4-10,4-14,5-1 to 5-7,5-17,6-1,6-4		
MODULE-4	**3D GEOMETRIC TRANSFORMATIONS, COLOR AND ILLUMINATION MODELS**	**24CDS454.3, 24CDS454.4**	**8 Hours**
Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only -polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm only.3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL geometric transformations functions. Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions.			
Text Book	Chapter :6-2 to 6-08 (Excluding 6-4),5-9 to 5-17(Excluding 5-15),12-1,12-2,12- 4,12-6,10-1,10-3		
MODULE-5	**3D VIEWING AND VISIBLE SURFACE DETECTION**	**24CDS454.5 24CDS454.6**	**8 Hours**

3DViewing:3D viewing concepts, 3D viewing pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates. OpenGL 3D viewing functions. Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method only and OpenGL visibility detection functions.

Applications	Develop a mini 3D room design application using OpenGL where the user can place objects (like tables, chairs, and shelves) in a room. Implement orthogonal and perspective projections to switch between blueprint view and realistic 3D view. Use a depth buffer for visible surface detection to ensure correct rendering of overlapping objects.
Text Book	Chapter: 7-1 to 7-10(Excluding 7-7), 9-1,9-3, 9-14

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) Donald D. Hearn, M. Pauline Baker, *Computer Graphics with OpenGL*, 4th Edition, Pearson, **ISBN-10:** 0136053580.
2) Edward Angel: Interactive Computer Graphics- A Top-Down approach with OpenGL, 5th edition. Pearson Education, 2008, ISBN-

Reference Books:

1) James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: pearson education
2) 2. Xiang, Plastock: Computer Graphics, sham‟s outline series, 2nd edition, TMG.
3) 3. Kelvin Sung, Peter Shirley, steven Baer: Interactive Computer Graphics, concepts and applications, Cengage Learning
4) 4. M M Raikar & Shreedhara K S Computer Graphics using OpenGL, Cengage publication

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc24_cs69/preview
- https://nptel.ac.in/courses/106/106/106106090/
- https://www.siggraph.org/learn/
- https://www.khronos.org/opengl/wiki

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

- Quizzes & Assignments

FUNDAMENTALS OF INFORMATION SECURITY			
Course Code	**24CDS455**	**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:

24CSK455.1	Understand the key principles of information security including confidentiality, integrity, and availability
24CSK455.2	Identify and classify information assets and perform risk assessments
24CSK455.3	Understand and apply security policies, standards, and governance roles
24CSK455.4	Apply technical and organizational controls for securing systems
24CSK455.5	Analyze real-world threats including malware, social engineering, and phishing
24CSK455.6	Evaluate security challenges in modern environments such as IoT, cloud, and mobile platforms

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS455.1	3	3	3	2	2	-	-	-	-	-	2	3	2
24CDS455.2	3	3	3	2	2	-	-	-	-	-	2	3	2
24CDS455.3	3	3	2	2	2	-	-	-	-	-	2	3	2
24CDS455.4	3	3	3	2	2	-	-	-	-	-	2	3	2
24CDS455.5	3	3	3	2	2	-	-	-	-	-	2	3	2
24CDS455.6	3	3	3	2	2	-	-	-	-	-	2	3	2

MODULE-1	**INTRODUCTION TO INFORMATION SECURITY**	**24CDS455.1**	**8 Hours**

Fundamentals of Information Security, Need for Information Security, The CIA Triad – Confidentiality, Integrity, Availability, Security Threats and Attacks, Vulnerabilities and Exploits, Threat Actors and Motivation, Principles of Security (Least Privilege, Défense in Depth, etc.), Non-repudiation and Authentication, Security Services and Mechanisms, Introduction to Security Models (Bell-LaPadula, Biba), Information Security Terminology, Real-world Security Breach Case Studies

Case study	Equifax Data Breach (2017) → Analyze how failures in confidentiality, integrity, and availability led to one of the biggest data leaks.
Text Book	Text Book 1: Chapter 1 (1.1–1.6) – Security Concepts, Attacks, Services, and Mechanisms Text Book 2: Chapter 1 – Introduction to Information Security, Chapter 2 – The Need for Security

MODULE-2	**ASSET IDENTIFICATION & RISK MANAGEMENT**	**24CDS455.2 24CDS455.3**	**8 Hours**

Asset Types & Classification, Asset Valuation Models, Threat Identification & Profiling, Vulnerability Assessment Techniques, Risk Concepts: Likelihood & Impact, Qualitative & Quantitative Risk Analysis, Risk Matrix, Risk Mitigation Strategies, Risk Transfer & Acceptance, Disaster Recovery Planning, Business Continuity Overview, Legal/Ethical aspects in risk evaluation

Applications	Risk Matrix Activity In grStudents create a simple Likelihood vs. Impact matrix for common threats (phishing, ransomware, hardware theft) to a university's IT lab, using chart paper or Excel
Text Book	Text Book 1: Chapter 4 (4.1, 4.2, 4.6, 4.8) – Block Cipher Principles, Data Encryption Standard, Strength of DES Text Book 2: Chapter 4 – Risk Management,, Chapter 5 – Incident Response and Contingency Planning

MODULE-3	**SECURITY POLICIES & GOVERNANCE**	**24CDS455.3**	**8 Hours**

Policy Lifecycle, Acceptable Use, BYOD, Data Handling Policies, Structure & Documentation of Policies, ISO 27001 & NIST framework, Role of Senior Management, Roles & Responsibilities: CISO, SOC, etc., Awareness Training Methods, Metrics & KPIs in Policy Effectiveness, Compliance Audits, Incident Response Plans, Ethics & Cybersecurity, Common audit failures & prevention

Case study	ISO 27001 Framework → Students research the ISO 27001 standard and summarize the controls relevant to universities or small organizations
Text Book	Text Book 1: Chapter 6 (6.1–6.3) – AES Structure, Finite Field Arithmetic, Key Expansion Text Book 2: Chapter 6 – Legal, Ethical and Professional Issues, Chapter 7 – Information Security Policy

MODULE-4	TECHNICAL & ORGANIZATIONAL CONTROLS	24CDS455.4	8 Hours

Control Types: Preventive, Detective, Corrective, Technical Controls: Firewalls, IDS/IPS, Organizational Controls: HR, Procedures, Physical Controls: Biometrics, CCTV, Authentication Methods, Authorization Models: DAC/MAC/RBAC , Encryption Techniques, Principle of Least Privilege, Access Control Lists (ACLs), Logging & Monitoring Tools, Data Loss Prevention (DLP), Control Testing & Auditing

Applications	Target Data Breach (2013) • Discuss how poor access controls and monitoring allowed attackers to steal 40 million credit/debit card details. • Students identify which preventive/detective controls failed (e.g., weak network segmentation, ignored alerts, Write how controls like IDS/IPS, monitoring, and least privilege could have reduced the impact
Text Book	Text Book 1: Chapter 5 (5.1–5.4), Chapter 7 – Symmetric Encryption and Access Control Models Text Book 2: Chapter 8 – Access Control Models and Mechanisms, Chapter 9 – Intrusion Detection and Prevention Systems)

MODULE-5	MODERN SECURITY CHALLENGES	24CDS455.5 24CDS455.6	8 Hours

Malware Types: Virus, Worms, Trojans, Ransomware, Rootkits, Spyware & Adware, Social Engineering (Phishing, Vishing), Email & Browser Security, Cloud Computing Risks, IoT Security Vulnerabilities, Mobile Device Security Management, Zero Trust Architecture, Insider Threat Detection, AI/ML in Security Defence, Emerging Threats & Trends (2024-25)

Case study	WannaCry Ransomware (2017) Students analyze how the ransomware spread globally, its impact on hospitals, and brainstorm preventive measures that could have reduced damage
Text Book	Text Book 1: Chapter 8 (8.1–8.4), Chapter 17 – Malware, Cloud and IoT Security Text Book 2: Chapter 10 – Malware and Attack Strategies, Chapter 11 – Security Implementation, Chapter 12 – Security Maintenance

CIE Assessment Pattern (50 Marks)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. William Stallings,"Cryptography and Network Security: Principles and Practice", 8th Edition, Pearson Education, 2023.
2. Michael E. Whitman and Herbert J. Mattord,"Principles of Information Security", 7th Edition, Cengage Learning, 2021

Reference Books:

1. Nina Godbole and Sunit Belapure, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Wiley India, 2017
2. Behrouz A. Forouzan, Cryptography and Network Security, McGraw-Hill Education, 2015
3. William Stallings, Network Security Essentials: Applications and Standards, Pearson Education, reprint 2021

Web links and Video Lectures (e-Resources):

1. NPTEL – Practical Cyber Security (by Prof. Sandeep Shukla, IIT Kanpur) https://nptel.ac.in/courses/106105031
2. SWAYAM – Introduction to Cyber Security (by Dr. Jeetendra Pande, Uttarakhand Open University) https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
3. YouTube – Information Security Full Course (Simplilearn) https://www.youtube.com/watch?v=8z6ksCuAGy0

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

4. CIA Triad Roleplay: Divide the class into 3 groups (Confidentiality, Integrity, Availability). Each group presents real- life examples of violations and how to prevent them.
5. Password Cracking Simulation: Use tools like Cain & Abel or online hash crackers to demonstrate password vulnerabilities (in a controlled virtual environment).
6. Security Policy Drafting Exercise: In teams, students draft sample Acceptable Use Policies or Email Usage Policies for a fictional organization.
7. Threat Modeling Workshop: Using a basic system diagram, have students identify assets, threats, vulnerabilities, and propose mitigation strategies.
8. Risk Matrix Activity: Each group builds a risk matrix using Likelihood vs. Impact for given scenarios (e.g., ransomware, phishing).
9. Incident Response Drill: Simulate a classroom security breach and assign students roles: CISO, Analyst, Communicator, Recovery Head. Let them respond and document actions.
10. Phishing Awareness Quiz: Conduct a “spot the phish” challenge using fake email examples — test students on identifying red flags.

Entrepreneurship and Innovation Management

Course Code	**24CDS456**	**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:

24CDS456.1	Explain the nature, importance, and functions of management, and illustrate the planning and decision-making process in organizations.
24CDS456.2	Analyze organizational structures, staffing processes, motivation theories, and communication systems to achieve managerial effectiveness.
24CDS456.3	Evaluate leadership styles, coordination techniques, control systems, and apply ethical principles and social responsibilities in business decision-making.
24CDS456.4	Discuss the concepts, types, and competencies of entrepreneurs, and apply models to identify and assess business opportunities.
24CDS456.5	Prepare business plans and analyze the role of institutional support at central, state, and other levels for setting up enterprises.
24CDS456.6	Integrate principles of management, leadership, entrepreneurship, and ethics to address organizational challenges and drive sustainable growth.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS456.1	1	1	1	1	-	-	-	-	1	1	-	1	1
24CDS456.2	1	1	1	1	-	-	-	-	1	1	-	1	1
24CDS456.3	1	1	1	1	-	-	-	-	1	1	-	1	1
24CDS456.4	1	1	1	1	-	-	-	-	1	1	-	1	1
24CDS456.5	1	1	1	1	-	-	-	-	1	1	-	1	1
24CDS456.6	1	1	1	1	-	-	-	-	1	1	-	1	1

MODULE-1	**INTRODUCTION**	**24CDS456.1**	**8 Hours**

Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1). Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making.

Text Book	Text Book **-1: Chapter 1**: Sections 1-1 to 1-9, **Chapter 2**: Sections 2-1 to 2-3, 2-8, 2-9, **Chapter 3**: Sections 3-1 to 3-5, 3-9, 3-14 to 3-20.

MODULE-2	**ORGANIZING AND STAFFING**	**24CDS456.2**	**8 Hours**

Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalization-Process Departmentalization, Purpose Departmentalization, Committees– Meaning, Types of Committees. Staffing-Need and Importance, Recruitment and

Selection Process. Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication

Text Book	Text Book -1: **Chapter 1**: Sections 1-1 to 1-9, **Chapter 2**: Sections 2-1 (pages 39–41), 2-8, 2-9,**Chapter 3**: Sections 3-1 to 3-5, 3-9, 3-20.

MODULE-3	**LEADERSHIP & SOCIAL RESPONSIBILITIES OF BUSINESS**	**24CDS456.3**	**8 Hours**

Leadership-Meaning, Characteristics, Behavioral Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process (Text 1). Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance

Text Book	Textbook-1:**Chapter 3**: Sections 3-14 to 3-16, **Chapter 4**: Sections 4-9, 4-10, 4-14, **Chapter 5**: Sections 5-1 to 5-7, 5-17,**Chapter 6**: Sections 6-1, 6-4

MODULE-4	**ENTREPRENEURSHIP**	**24CDS456.4, 24CDS456.4**	**8 Hours**

Entrepreneurship: Introduction, Evolution of the concept of Entrepreneurship, Entrepreneurship today, Types of Entrepreneurs, Intrapreneurship, Entrepreneurial competencies, Capacity Building for Entrepreneurs. Identification of Business Opportunities: Introduction, Mobility of Entrepreneurs, Business opportunities in India, Models for Opportunity Evaluation.

Text Book	Textbook 1: Chapter 6: Sections 6-2 to 6-08 (excluding 6-4), Chapter 5: Sections 5-9 to 5-17 (excluding 5-15), TextBook2: Chapter 12: Sections 12-1, 12-2, 12-4, 12-6, Chapter 10: Sections 10-1, 10-3.

MODULE-5	**INSTITUTIONS SUPPORTING BUSINESS OPPORTUNITIES**	**24CDS456.5, 24CDS456.6**	**8 Hours**

Business plans : Introduction, purpose of a Business plan, contents of a Business plan, presenting a Business plan, why do some Business plan fail? Procedure for setting up an Enterprise. Institutions supporting Business opportunities: Central level institutions- National Board for micro, small & medium Enterprises(NBMSME),MSME-DO, National Small Industries Corporation. State level institutions- state Directorate Industries and commerce, District Industries Centres, state financial Corporations, State Industrial Development Corporation (SIDC), State Industrial Area Development Board (SIADB). Other Institutions - NABARD, Technical consultancy organisation (TCO), Small Industries Development Bank of India(SIDBI), Export Promotion Councils, Non-governmental Organizations.

Text Book	Textbook 2: Chapter 11 – Supporting Institutions for Business, Chapter 13 – Business Plans and Project Report

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. Principles of Management – P.C Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath,2nd Edition, Pearson Education 2018, ISBN 978-81-317-6226-4.

Reference Book:

1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/110107094
- https://nptel.ac.in/courses/110106141
- https://nptel.ac.in/courses/122106031

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

- Case Study

DATA VISUALIZATION

Course Code	**24CDS461**	**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:

24CDS461.1	Implement the main concepts of data visualization
24CDS461.2	Apply the main chart types and their recommended usage
24CDS461.3	Design application with the Knowledge on Menus, Form Filling, Dialog boxes.
24CDS461.4	Use Power BI for data cleaning and visualization

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS461.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS461.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS461.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS461.4	3	3	3	3	2	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Data Visualization, Analyzing Charts to derive insights**	2	NA
	PART-A		
1	Introduction to data visualization	2	24CDS461.1

2	First steps in Tableau	2	24CDS461.1
3	Design required modules	2	24CDS461.2
4	Creating core chart visuals in Tableau	2	24CDS461.2
5	Visual best practices	2	24CDS461.3
6	Filtering and sorting data in Tableau	2	24CDS461.3
PART-B			
7	Formatting charts and visuals in Tableau	2	24CDS461.3
8	Interactive data visualizations	2	24CDS461.3
9	Working with multiple charts in a dashboard	2	24CDS461.3
10	Load csv data and perform basic data cleansing operations in Power BI • Remove empty rows • Fix data types (Date, Number) • Rename columns • Load data into the report view. • Save the PBIX file.	2	24CDS461.4

11	Create a simple dashboard in Power BI with multiple charts
	• Use the cleaned *SalesData*.
	• Create following charts
	  ○ **Bar chart**: Total Sales by Product
	  ○ **Line chart**: Sales trend over Date
	  ○ **Pie chart**: Sales distribution by Region
	• Format charts (titles, colors, labels).
	• Arrange visuals into a dashboard layout.
		2	24CDS461.4

12	Personal project	2	24CDS461.4
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
L3	Apply	5	10
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1) "Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few Website: Perceptual Edge, ISBN-13:978-1600330193
2) "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky". Website: O'Reilly Media, SBN :1449390684, 781449390686

Web Resources:

3) https://www.tableau.com/learn/training

ETHICAL HACKING PRACTICES

Course Code	**24CDS462**	**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:

24CDS462.1	Understand the basics of computer-based vulnerabilities.
24CDS462.2	Analyze the different foot printing, reconnaissance and scanning methods.
24CDS462.3	Apply the various hacking options available in Web and wireless applications and explore the options for network protection
24CDS462.4	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	PSO1	PSO2
24CDS462.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS462.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS462.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS462.4	3	3	3	3	2	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Introduction to Linux programming		NA
	PART-A		
1	Install Kali or Backtrack Linux / Meta sploitable/ Windows XP	2	24CDS462.1
2	Practice the basics of reconnaissance.	2	24CDS462.2
3	. Using FOCA / Search Diggity tools, extract metadata and expanding the target list.	2	24CDS462.2
4	Aggregates information from public databases using online free tools like Paterva's Maltego.	2	24CDS462.2
5	Information gathering using tools like Robtex.	2	24CDS462.2
6	Scan the target using tools like Nessus.	2	24CDS462.2
	PART-B		

7	View and capture network traffic using Wireshark.	2	24CDS462.3
8	Automate dig for vulnerabilities and match exploits using Armitage	2	24CDS462.3
9	Web Server, SQL Injection, Cross Site Scripting	2	24CDS462.3
10	Exploit Writing, Buffer Overflow	2	24CDS462.3
11	Incident Handling & Response	2	24CDS462.4
12	Bluetooth Hacking, Mobiles Phone Hacking.	2	24CDS462.4

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

1) Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010, ISBN, 1133169031, 9781133169031
2) 2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013, SBN: 9780124116443
3) The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011, ISBN-13:978-1118026472
4) Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz, 2014, ISBN-13: 978-1593275907

PROGRAMMING FOR UI AND UX DESIGN

Course Code	**24CDS463**	**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:

24CDS463.1	Ability to understand the goals of user interface design.
24CDS463.2	Implement the design processes and development methodologies in UI.
24CDS463.3	Design application with the Knowledge on Menus, Form Filling, Dialog boxes.
24CDS463.4	Implement user interaction with interfaces and designing intuitive interactions.
24CDS463.5	Web and UI design using Figma and Webflow

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS463.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS463.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS463.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS463.4	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS463.5	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Basic experience with drawing and layout tools** • **Latest browser Chrome/Edge to access Webflow** • **Install Figma**	2	NA
	PART-A		
1	1. Create a Project in Figma. 2. Create a design system with linked UI components in Figma.	2	24CDS463.1
2	1. Create a project for UI and UX design using wonder share Mockitt tool. 2. Add UX design Widgets.	2	24CDS463.1
3	Create a simple layout using basic shapes and learn alignment tools. 1. Draw a rectangle, circle, and triangle using the **Shape Tool**. 2. Change fill colors and border radius. 3. Use the **Align panel** to center shapes horizontally and vertically.	2	24CDS463.2

	4. Group them and name the layer group.		
4	Create and preview interactions for UX design.	2	24CDS463.3
5	Build a navigation menu with components in Figma.	2	24CDS463.3
6	Designing and prototyping forms in Figma.	2	24CDS463.3
PART-B			
7	Create a dialog box in Figma.	2	24CDS463.4
8	Create connections and flows in Figma	2	24CDS463.4
9	Implement interactive design and functional layout.	2	24CDS463.4
10	Create a working UI/UX prototype using prototyping tools.	2	24CDS463.4
11	Data Visualization design tool for UI/UX Designers.	2	24CDS463.5
12	Create a web design for any project using Webflow	2	24CDS463.5

PART-C

Beyond Syllabus Virtual Lab Content

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

- **https://www.figma.com/prototyping/**
- **https://liveweave.com/**
- **https://codesandbox.io/p/sandbox/html-css-js-editor-sf3el**

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

4) Designing the user interface strategies for effective Human-Computer Interaction, Third Edition by Ben Shneiderman, ISBN-13:978-0201694970
5) The Essential Guide to User Interface Design - d Edition: An Introduction to GUI Design Principles and Techniques Paperback – Import, 17 April 2007by WO Galitz., ISBN-13:978-0470053423

C # AND . NET

Course Code	**24CDS464**	**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:

24CDS464.1	Understand the technologies of the .NET framework
24CDS464.2	Understand the basic and object-oriented concepts in C#.
24CDS464.3	Model the real-world entities as classes and objects using C# object-oriented Programming concepts.
24CDS464.4	Apply exception handling and gain efficient testing, debugging skills C#.
24CDS464.5	Applying interfaces and Events in C# programming.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CDS464.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS464.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS464.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS464.4	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS464.5	-	-	3	3	3	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Programming in C** • **Visual Studio or VS code** • **. NET SDK**	2	NA
	PART-A		
1	Create a console application and write a C# Sharp program to print first 100 prime numbers.	2	24CDS464.1
2	Develop C# program to show command line arguments.	2	24CDS464.1
3	Demonstrate boxing and unboxing in C#.	2	24CDS464.1
4	Develop C# application using classes and object to display student data. Create a Student class with constructor for initializing attributes	2	24CDS464.2

5	Write a C# program to create a class Car with properties and methods and demonstrate object creation and method calling.	2	24CDS464.3
6	Write a C# Program to create an interface Shape with method draw(). Write classes Rectangle and Circle that implement Shape interface.	2	24CDS464.3
PART-B			
7	Write a C# program to demonstrate single inheritance where Car is the base class and ElectricCar is the derived class.	2	24CDS464.3
8	Write a C# program to define a delegate and perform function call using delegate. Pass the delegate to a function as a parameter.	2	24CDS464.4
9	Write a C# program to handle runtime error for divide by zero using try–catch.	2	24CDS464.4
10	Write a C# program to create and use a custom (user-defined) exception for validating marks.	2	24CDS464.4
11	Write a C# program to demonstrate the difference between checked and unchecked contexts	2	24CDS464.4
12	Develop a small window-based application using C#	2	24CDS464.5

PART-C

Beyond Syllabus Virtual Lab Content

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

1. Write a C# program to fetch data asynchronously using async, await and threading.Task, simulating a real-world delay (like fetching from a database or API).
2. Write a C# program to use LINQ for filtering, grouping, and projecting data from a collection.

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

6) HerbertSchildt, "TheCompleteReference:C#4.0", TataMcGrawHill, 2012.ISBN-13:978-0071741163
7) Mark J. Price," C# 8.0 and .NET Core 3.0" – Modern Cross-Platform Development, Fourth Edition, Expert Insight, 2019, ISBN-13:978-1788478120

CLOUD-BASED COLLABORATIVE WORKSPACE

Course Code	**24CDS465**	**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:

24CDS465.1	Demonstrate the access and setting of google account creation and management
24CDS465.2	Demonstrate the collaboration tools such as Classroom, Docs, Sheets, Slides, Forms and Drive
24CDS465.3	Create a Virtual Machine using Oracle Virtual Box and test the communication between the guest OS and Host OS using the PING command
24CDS465.4	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	PSO1	PSO2
24CDS465.1	2	2	3	3	3	-	-	-	-	-	-	3	3
24CDS465.2	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS465.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24CDS465.4	3	3	3	3	2	-	-	-	-	-	-	3	3
24CDS465.5	3	3	3	3	2	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Cloud Storage** • **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	24CDS465.1
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	2	24CDS465.2

	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		
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	24CDS465.2
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	24CDS465.2
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	24CDS465.2
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	2	24CDS465.2

	f) Announcement banner g) Site Sharing and Collaboration h) Google Sites Launch		
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	24CDS465.3
8	Install Oracle Virtual box and create two VMs on your laptop/Desktop.	2	24CDS465.3
9	Use version control systems to create a central repository and local repository.	2	24CDS465.3
10	Use version control systems command to clone, commit, push, fetch, pull, checkout, reset, and delete repositories.	2	24CDS465.3
11	Develop a Hello World application using Google App Engine in Eclipse.	2	24CDS465.4
12	Create a hello world app and other simple web applications using python/java. Use GAE launcher to launch the web applications.	2	24CDS465.4

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:

7. *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, DOI:10.37745/bjmas.2022.0073*
8. *Sunyaev, A., & Schneider, S. (2013). Cloud services certification. Communications of the ACM, 56(2), 33-36, https://doi.org/10.1145/2408776.2408789*

UNIVERSAL HUMAN VALUES AND LIFE SKILLS

Course Code	**24UHK47**	**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:

24UHK47.1	Understand the concept and significance of life skills and universal human values.
24UHK47.2	Develop Self-awareness and Self-management skills to promote personal growth.
24UHK47.3	Apply Critical and Creative thinking and ethical decision-making skills in various contexts.
24UHK47.4	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	PSO1	PSO2
24UHK47.1	-	-	-	-	-	3	1	2	-	2	2		
24UHK47.2	-	-	-	-	-	1	2	3	1	2	3		
24UHK47.3	-	-	-	-	-	3	1	2	1	3	2		
24UHK47.4	-	-	-	-	-	2	2	3	2	2	1		

MODULE-1	**Self-Awareness and Self-Management**	**24UHK47.1, 24UHK47.2**	**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**	**24UHK47.1, 24UHK47.3**	**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**	**24UHK47.3, 24UHK47.4**	**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.			
Case study	Case studies for Critical thinking and activities for Creative thinking		
MODULE-4	**Ownership towards Family and Society**	**24UHK47.2, 24UHK47.3 24UHK47.4**	**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**	**24UHK47.3, 24UHK47.4**	**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)	**AAT1**	**AAT2**
		25	**15**	**10**
L1	**Remember**	-	-	-
L2	**Understand**	5	-	5
L3	**Apply**	10	5	5
L4	**Analyze**	10	5	-
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 Guntreddy.

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

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

NATIONAL SERVICE SCHEME

Course Code	**24NSS40**	**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:

24NSS40.1	Understand the importance of his / her responsibilities towards society.
24NSS40.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSS40.3	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.
24NSS40.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24NSS40.1	-	-	-	-	-	3	3	2	-	-	1
24NSS40.2	-	-	-	-	-	3	3	2	-	-	1
24NSS40.3	-	-	-	-	-	3	3	2	-	-	1
24NSS40.4	-	-	-	-	-	3	3	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3RD 24NSS30	**12.** Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing **13.** Waste management–Public, Private and Govt organization, 5R's. **14.** Setting of the information imparting club for women leading to contribution in social and economic issues.	24NSS30.1, 24NSS30.2, 24NSS30.3, 24NSS30.4	30 HRS
4TH 24NSS40	**15.** Water conservation techniques – Role of different stakeholders– Implementation. **16.** Preparing an actionable business proposal for enhancing the village income and approach forimplementation. **17.** Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	24NSS40.1, 24NSS40.2, 24NSS40.3, 24NSS40.4	30 HRS
5TH 24NSS50	**18.** Developing Sustainable Water management system for rural areas and implementationapproaches. **19.** Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. **20.** Spreading public awareness under rural outreach programs. (minimum 5 programs).	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS

6TH 24NSS60	**21.** Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). **22.** Govt. school Rejuvenation and helping them to achieve good infrastructure.	24NSS60.1, 24NSS60.2, 24NSS60.3, 24NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

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

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

Suggested Learning Resources:
Reference Books:

13. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
14. Government of Karnataka, NSS cell, activities reports and its manual.
15. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

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

Pedagogy:

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

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:

- Lecture session by NSS Officer
- Students Presentation on Topics
- Presentation - 1, Selection of topic, PHASE – 1
- Commencement of activity and its progress - PHASE – 2
- Execution of Activity
- Case study-based Assessment, Individual performance
- Sector/ Team wise study and its consolidation
- Video based seminar for 10 minutes by each student at the end of semester with Report.

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

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

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

PHYSICAL EDUCATION AND SPORTS

Course Code	**24PED40**	**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:

24PED40.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PED40.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PED40.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PED40.4	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
24PED40.1	-	-	-	-	-	2	-	3	3	-	-	2
24PED40.2	-	-	-	-	-	2	-	3	3	-	-	2
24PED40.3	-	-	-	-	-	2	-	3	3	-	-	2
24PED40.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
3RD 24PED30	**Module 1: Orientation** F. Lifestyle, G. Fitness H. Food & Nutrition I. Health & Wellness J. Pre-Fitness test.	24PED30.1, 24PED30.2	5 HRS
	Module 2: General Fitness & Components of Fitness G. Warming up (Free Hand exercises) H. Strength – Push-up / Pull-ups I. Speed – 30 Mtr Dash J. Agility – Shuttle Run K. Flexibility – Sit and Reach L. Cardiovascular Endurance – Harvard step Test	24PED30.2, 24PED30.3	15 HRS
	Module 3: Recreational Activities E. Postural deformities. F. Stress management. G. Aerobics. H. Traditional Games.	24PED30.3, 24PED30.4	10 HRS
4TH 24PED40	**Module 1: Ethics and Moral Values** C. Ethics in Sports D. Moral Values in Sports and Games	24PED40.1, 24PED40.2	5 HRS
	Module 2: Specific Games (Anyone to be selected by the student) G. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. H. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw.	24PED40.3	20 HRS

	I. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. J. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. K. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. L. Athletics (Track / Field Events) – Any event as per availability of Ground.		
	Module 3: Role of Organization and administration	24PED40.4	5 HRS
5TH 24PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 4. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 5. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 6. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** B. Fundamental Skills 7. Catching, Throwing and Ball control, 8. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 9. Dribbling: High and low. 10. Attack and counter attack, simple counter attack, counter attack from two wings and center. 11. Blocking, Goal Keeping and Defensive skills. 12. Game practice with application of Rules and Regulations. C. Rules and their interpretations and duties of officials **Ball badminton:** B. Fundamental Skills 5. Basic Knowledge: Various parts of the Racket and Grip. 6. Service: Short service, Long service, Long-high service. 7. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	24PED50.1, 24PED50.2, 24PED50.3, 24PED50.4	Total 30 Hrs./ Semester 2 Hrs/week
6TH 24PED60	**Athletics**: 4. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 5. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 6. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills	24PED60.1, 24PED60.2, 24PED60.3, 24PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 10. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 11. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 12. Heading: In standing, running and jumping condition. 13. Throw-in: Standing throw-in and Running throw-in. 14. Feinting: With the lower limb and upper part of the body. 15. Tackling: Simple Tackling, Slide Tackling. 16. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 17. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 9. Penalty stroke practice. 10. Penalty corner practice. 11. Tackling: Simple Tackling, Slide Tackling. 12. Goal Keeping, Ball clearance- kicking, and deflecting. 13. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials		

CIE Assessment Pattern (50 Marks – Practical) –

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

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

Suggested Learning Resources:

Reference Books:

12. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
13. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
14. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
15. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
16. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
17. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
18. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
19. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
20. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.

21. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
22. Rachana Jain, Teach Yourself Basketball, Sports Publication.
15. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
16. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
17. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA

Course Code	**24YOG40**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

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

24YOG40.1	Understanding the origin, history, aim and objectives of Yoga
24YOG40.2	Become familiar with an authentic foundation of Yogic practices
24YOG40.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
24YOG40.4	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
24YOG40.1	-	-	-	-	-	3	-	-	-	-	1
24YOG40.2	-	-	-	-	-	3	-	-	-	-	1
24YOG40.3	-	-	-	-	-	3	-	-	-	-	1
24YOG40.4	-	-	-	-	-	3	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd 24YOG30	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 3. Suryanamaskar prayer and its meaning, Need, importance and benefi Suryanamaskar. 4. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 5. Sitting: Padmasana, Vajrasana, Sukhasana 6. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 7. Prone line: Bhujangasana, Shalabhasana 8. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	24YOG30.1, 24YOG30.2, 24YOG30.3, 24YOG30.4	Total 32 Hrs./ Semester 2 Hrs/week
4TH 24YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **Different types of Asanas**: 5. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 6. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 7. Prone line: Dhanurasana 8. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	24YOG40.1, 24YOG40.2, 24YOG40.3, 24YOG40.4	Total 32 Hrs./ Semester 2 Hrs/week

5TH 24YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 5. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 6. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 7. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 8. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	24YOG50.1, 24YOG50.2, 24YOG50.3, 24YOG50.4	Total 32 Hrs./ Semester 2 Hrs/week
6TH 24YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 5. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 6. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 7. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 8. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	24YOG60.1, 24YOG60.2, 24YOG60.3, 24YOG60.4	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:

16. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
17. Tiwari, O P: Asana Why and How
18. Ajitkumar: Yoga Pravesha (Kannada)
19. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
20. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
21. Nagendra H R: The art and science of Pranayama
22. Tiruka: Shatkriyegalu (Kannada)
23. Iyengar B K S: Yoga Pradipika (Kannada)
24. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

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

APPENDIX A

List of Assessment Patterns

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.

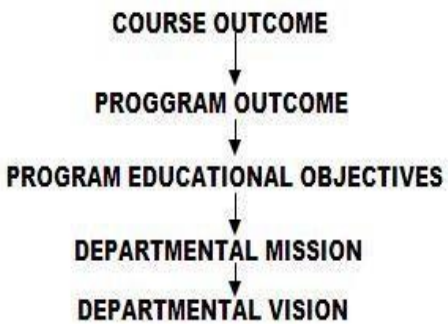
There are three educational Outcomes as defined by the National Board of Accreditation:

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

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

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

Mapping of Outcomes



APPENDIX C

The Graduate Attributes of NBA

Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct investigations of complex problems	The problems that cannot be solved by 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.