NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Science and Engineering

Academic Year

2025-26

3rd and 4th Semester Scheme & Syllabus
2025-26
BATCH: 2024-28
CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING

VISION

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

MISSION

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

QUALITY POLICY

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

VALUES

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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

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

MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Graduate of the program will be able to:

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

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

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

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

PEO TO MISSION STATEMENT MAPPING

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

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

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)

The student will be able to:

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 analyse 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 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)

PROGRAM SPECIFIC OUTCOMES (PSOs)

The student will be able to:

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

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

MAPPING OF PEOs to POs & PSOs

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

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

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Computer Science and Engineering
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	Numerical Methods and Probability	BS	2	1	0	0	3	4	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	HSMS	24CSK35	Software Engineering and Project Management	CS	3	0	0	0	3	3	50	50	**100**
8	AEC	24CSE36X	Ability Enhancement Course – III	CS	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	24UHK37	Universal Human Values and Life Skills	Any Dept	1	0	0	0	1	2	50	50	**100**
10	NCMC	24NSS30	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED30	Physical Education and Sports	-									
		24YOG30	Yoga	-									
								Total	**19**	**25/26**	**500**	**450**	**950**

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

NCMC*:24DMAT31: This non-credit mandatory course to be offered to Lateral entry students.

Ability Enhancement Course – III (0-0-1-0)			
24CSE361	Web Design Technologies	24CSE364	Microsoft Visio
24CSE362	Advanced Excel for Data Analysis	24CSE365	Bio Inspired Design and Innovation (1-0-0-0)
24CSE363	Project Management with Git		

24XXX35(HSMS)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.
For IT allied Branches: Software Product Management
For Core Branches: Engineering Economics and Management / Industrial Management and Entrepreneurship.

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
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	Discrete Mathematics and Graph Theory	BS	2	1	0	0	3	4	50	50	**100**
2	PCC	24CSK42	Object Oriented Programming using Java	CS	3	0	0	0	3	3	50	50	**100**
3	PCCL	24CSLK42	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	Linux Operating System Lab	CS	0	0	1	0	1	2	50	50	**100**
6	PCC	24CSK44	Database Management Systems	CS	3	0	0	0	3	3	50	50	**100**
7	PCCL	24CSLK44	Database Management Systems Lab	CS	0	0	1	0	1	2	50	50	**100**
8	PEC	24CSE45X	Professional Elective Course-I	CS	3	0	0	0	3	3	50	50	**100**
9	AEC	24CSE46X	Ability Enhancement Course – IV	CS	0	0	1	0	1	2	50	50	100
10	UHV	24DTK47	Design Thinking and Fabrication	Any Dept	1	0	0	0	1	2	50	50	**100**
11	PROJ	24CSE48	Mini Project	CS	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**	**28**	**600**	**550**	**1150**

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.

NCMC*: 24DMAT41: This non-credit mandatory course to be offered to Lateral entry students.

Professional Elective Course-I			
24CSE451	Knowledge Engineering	24CSE454	Computer Graphics
24CSE452	Introduction to Cloud Computing and Virtualization	24CSE455	Fundamentals of Information Security
24CSE453	Software Testing and Automation	24CSE456	Entrepreneurship and Innovation Management

Ability Enhancement Course – IV (0-0-1-0)			
24CSE461	IoT Programming	24CSE464	UI / UX Design
24CSE462	Automated Software Testing with Tosca	24CSE465	Programming in C++
24CSE463	Data Visualization with Python		

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

Third Semester Syllabus

NUMERICAL METHODS AND PROBABILITY
(Common to AIML, CSE and 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
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: 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 AND INTEGRATION**	**24MAC31.2**	**8 Hours**

Numerical solution of ordinary differential equations of first order and of first degree: Taylor's series method, Modifie Euler's method and Runge-Kutta method of fourth-order-Problems. Milne's predictor and corrector methods-Problem Numerical integration: Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddle's rule (without proofs)-Problem 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, Expectation and Standard Deviation. Discrete Probability distributions: Binomial and Poisson Distributions-Problems. Continuous Probability distribution: Normal Distributions-Problems. Concept of joint probability-Joint probability distribution, Dependent and Independent random variables., 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 1/3rd rule problems	24MAC31.2
4.	Uses of Simpson's 3/8th 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	-	-
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	5
L2	Understand	5
L3	Apply	15
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	3	3	3	3	2	-	-	-	-	-	2	2	2
24CSK32.2	3	3	3	3	2	-	-	-	-	-	2	2	2
24CSK32.3	3	3	3	3	2	-	-	-	-	-	2	2	2
24CSK32.4	3	3	3	3	2	-	-	-	-	-	2	2	2
24CSK32.5	3	3	3	3	2	-	-	-	-	-	2	2	2
24CSK32.6	3	3	3	3	2	-	-	-	-	-	2	2	2

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		Test (s)	Marks Distribution AAT1	AAT2	AAT3
		25	7.5	7.5	10
L1	Remember	5	-	-	-
L2	Understand	5	2.5	2.5	-
L3	Apply	5	2.5	2.5	5
L4	Analyze	5	2.5	2.5	5
L5	Evaluate	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	**01**	**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	PSO1	PSO2
24CSLK32.1	3	3	3	3	3	-	-	-	-	-	3	2	2
24CSLK32.2	3	3	3	3	3	-	-	-	-	-	3	2	2
24CSLK32.3	3	3	3	3	3	-	-	-	-	-	3	2	2
24CSLK32.4	3	3	3	3	3	-	-	-	-	-	3	2	2

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 of array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position (POS) e.Exit. Support the program with functions for each of the above operations.	2	24CSLK32.1
2a.	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

3a.	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations	2	24CSLK32.2
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	2	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 Inorder, 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 LAB			
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**	**-**

Pgm. No.	List of Programs	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 b) Parallel adder	2	24CSLK33.3
2b.	Write a Verilog code to simulate the following circuit:	2	24CSLK33.3
	a) MUX b) De-MUX		

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		Test(s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	5	10
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:

	PO1	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	-	1	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 Writewell 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, Unbalanced transportation problem, Basic feasible solution using different methods, Optimality Methods, Degeneracy in transportation problems, 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	1	-
24CSK35.2	2	-	2	-	2	2	-	2	-	-	2	1	-
24CSK35.3	2	2	2	2	2	2	-	2	-	-	2	1	-
24CSK35.4	2	2	2	2	2	2	-	2	-	2	2	1	1
24CSK35.5	2	2	2	2	2	2	-	2	-	2	2	1	1
24CSK35.6	2	2	2	2	2	2	-	2	-	2	2	1	1

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

MODULE-2	**REQUIREMENTS ENGINEERING**	**24CSK35.2**	**8 Hours**

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.

Applications	Identify a simple software project or system and draw SRS for the same
Text Book3	Text Book 3: Chapter 4.1 to 4.7

MODULE-3	SOFTWARE DESIGN	24CSK35.3	8 Hours
Approaches to Software Design: Developing the Data Flow Diagram, UML diagram, Use case diagrams, Class diagram, interaction diagram, activity diagram, and state chart diagrams.			
Applications	Identify a simple software project or system and draw the corresponding DFD, UML, Class, interaction, activity and state chart diagrams		
Text Book	Text Book 2: 6.2, 7.2 to 7.8		
MODULE-4	**MANAGING SOFTWARE PROJECTS**	**24CSK35.4**	**8 Hours**
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			
Applications	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.		
Text Book	Text Book 1: Chapter 24.1 to 24.6, Chapter 25.1 to 25.6		
MODULE-5	**RISK MANAGEMENT**	**24CSK35.5, 24CSK35.6**	**8 Hours**
Reactive versus proactive Risk Strategies, software Risks, Risk Identification, Risk Projection, Risk refinement, Risk mitigation, monitoring and management, The RMMM plan.			
Case Study	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		
Text book 1	Text Book 1: Chapter 26: 26.1 to 26.7		

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=AfmBOor5x5ldCizp1dXfnY9RvF7fYyhshBGixnAxyR7XM3Q1iYg 4tD_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

Ability Enhancement Course–III	
24CSE361	Web Design Technologies
24CSE362	Advanced Excel for Data Analysis
24CSE363	Project Management with Git
24CSE364	Microsoft Visio
24CSE365	Bio Inspired Design and Innovation (1-0-0-0)

WEB DESIGN TECHNOLOGIES			
Course Code	**24CSE361**	**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:

24CSE361.1	Demonstrate an understanding of how HTML is used to create the structure and hierarchy of web pages.
24CSE361.2	Create well designed, responsive and visually appealing websites using advanced CSS techniques and staying up to date with industry trends.
24CSE361.3	Apply XHTML and JavaScript knowledge to build web content with proper structure and dynamic functionality.
24CSE361.4	Analyze XML documents to ensure proper structure and data integrity to evaluate the suitability for specific use cases.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE361.1	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE361.2	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE361.3	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE361.4	3	3	3	3	2	-	-	-	1	1	1	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs / Demo		
	• Basic Computer Literacy. • Basic understanding of graphics design principles, including colour, layout and typography.	2	NA
	PART-A		
1	Design a static login page that involves creating a simple and effective webpage that allows users to enter their credentials to access a secure area.	2	24CSE361.1
2	Design a class timetable using the colspan and rowspan attributes in HTML, which can help to create an organized and visually appealing layout. Create a simple class timetable for a week (Monday to Friday) and number of class sessions per day.	2	24CSE361.1
3	Design a user form with a variety of controls as a fundamental task in web development. Create a user form that includes at least six different types of controls: lists (select menus), text boxes, radio buttons, checkboxes, a drop-down menu and submit/reset buttons. (Assume your own use cases)	2	24CSE361.1
4	Design a web page with CSS to style lists and tables, which can significantly enhance the visual appeal and readability of your content.	2	24CSE361.1
5	Design a web page using CSS to set background images for the entire page and individual elements, while controlling the repetition of the image using the background-repeat property, which can create an engaging and visually appealing design.	2	24CSE361.2
6	Design a web page using various selector forms with the assistance of CSS, which allows you to precisely target and style different elements within the webpage.	2	24CSE361.2
	PART-B		

7	Create a HTML page with a dropdown menu featuring a list of five countries and dynamically displaying their corresponding capitals using CSS to customize the font properties as a common web development task.	2	24CSE361.2
8	Create a XHTML document with three stacked paragraphs that smoothly elevate to the top for full visibility when the cursor hovers over any part of a paragraph.	2	24CSE361.2
9	Create a XHTML document enhanced with JavaScript to manage three short text paragraphs that gracefully return to their original location when moved, rather than being sent to the bottom using the **z-index** property.	2	24CSE361.3
10	Create a JavaScript code that generates an HTML page capable of taking a set of integer numbers and arranging them in descending order involves building both the HTML structure and the JavaScript functionality.	2	24CSE361.3
11	Create an XML document to store information about an airline system and then using a CSS style sheet to style and display the data involved. The Airline systems XML structure comprises airline number, name, destination, price, date of journey, and time of journey.	2	24CSE361.4
12	Create an XML document to store information about students at NHCE (New Horizon College of Engineering) and use a CSS style sheet to display the data: USN (University Serial Number), Name, Name of the College, Branch, Year of Joining, and Email ID.	2	24CSE361.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. https://html-iitd.vlabs.ac.in/exp/introduction-to-html/references.html
2. https://www.cybrary.it/practice-lab/introduction-to-programming-using-java-script

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:

1) Robert W. Sebesta: Programming the World Wide Web, 8th Edition, 2020, Pearson Education, ISBN-13:978-9353946142, ISBN-10: 935394614X
2) M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 5th Edition, Pearson education, 2018. ISBN: 9789352868599, 9352868595

ADVANCED EXCEL FOR DATA ANALYSIS			
Course Code	**24CSE362**	**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:

24CSE362.1	Develop expertise in performing advanced What-If analysis and logical functions.
24CSE362.2	Demonstrate competence in applying Lookup Functions and creating Pivot Tables in Excel to analyze data and Array Functions, crafting Charts, and implementing Slicers in Excel to dynamically visualize data and optimize analytical capabilities.
24CSE362.3	Create VBA Macros in Excel to automate tasks, streamline workflows, and enhance productivity.
24CSE362.4	Automate email processes using VBA in Excel, enhancing communication and workflow efficiency.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE362.1	3	3	2	2	1	-	-	-	-	-	1	**2**	3
24CSE362.2	3	3	2	2	1	-	-	-	-	-	1	2	3
24CSE362.3	3	3	2	2	1	-	-	-	-	-	1	2	3
24CSE362.4	3	3	2	2	1	-	-	-	**-**	**-**	1	2	3

Pgm. No.	List of Program	Hours	COs
	Prerequisite		
	NA	NA	NA
	PART-A		
1.	Create a loan table and use the "What-If Analysis" tool to determine the monthly installment amounts based on different interest rates and loan durations. We have a gift voucher valued at Rs. 10,000. After selecting a list of items, the total cost comes to Rs. 9,300. We want to utilize the entire amount of the gift voucher when purchasing these items. To achieve this, we can use the Solver Tool along with logical functions to determine the best way to spend exactly Rs. 10,000. Apply the following three data validation requirements. 1. **Name**: Limit the input to 3-7 characters. 2. **Date of Birth**: Only allow dates between 1st January 2000 and 1st January 2021. 3. **Exam Center**: Restrict the selection to a predefined list of cities.	2	24CSE362.1
2.	a) Create a worksheet linking with Indirect, Vlookup with Helper Column. b) Create a Smooth User Interface using Lookup (Vlookup / Hlookup).	2	24CSE362.1
3.	Given a dataset containing sales data (e.g., date, product, region, sales amount). Create a pivot table to analyze the total sales, average sales, group the sales data by quarters, sales data for specific region.	2	24CSE362.1
4.	Create an Array Formula that incorporates the IF, LEN, and MID functions to manipulate text data.	2	24CSE362.1

5.	Demonstrate advanced use of Array Formulas by combining multiple functions to solve a complex problem.	2	24CSE362.2
6.	Design an excel Dashboard with adding tables, charts and dynamic content.	2	24CSE362.2
PART-B			
7.	Create, run and edit a recording a Macro in Excel.	2	24CSE362.3
8.	Demonstrate how to call both the procedure and function from VBA module.	2	24CSE362.3
9.	Create a VBA procedure that combines both MsgBox and InputBox.	2	24CSE362.3
10.	Demonstrate how to use the Namespace to access different folders in Outlook (e.g., Inbox, Sent)	2	24CSE362.4
11.	Write a VBA macro that merges multiple worksheet into a single consolidated sheet.	2	24CSE362.4
12.	Write a VBA macro that splits single worksheet into a multiple sheet.	2	24CSE362.4

PART-C

Beyond Syllabus Virtual lab Content

1. https://www.youtube.com/watch?v=fYQCpp61Sz0
2. https://learn.microsoft.com/en-us/office/vba/outlook/how-to/using-visual-basic-to-customize-outlook-forms/using-the-outlook-object-model
3. https://www.simplilearn.com/tutorials/excel-tutorial/send-email-in-excel
4. https://www.youtube.com/watch?v=T2BywGwyTsA

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test(s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	5	10
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. Microsoft Excel Formulas and Functions by Paul McFedries, 2019 ISBN: 978-1509306190
2. Excel Power Programming with VBA" book by Michael Alexander and Richard Kusleika, 2019 ISBN-13: 978- 1119514923

Web links and Video Lectures (e-Resources):
1. https://www.excel-easy.com/
2. https://www.mrexcel.com/
3. http://www.improveyourexcel.com

PROJECT MANAGEMENT WITH GIT			
Course Code	**24CSE363**	**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:

24CSE363.1	Understand the fundamental concepts of Git to perform version control tasks.
24CSE363.2	Apply Git commands to create and manage branches.
24CSE363.3	Analyze the concept of collaboration and working with remote repositories.
24CSE363.4	Examine Git history to manage various versions of codebase.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE363.1	2	-	-	-	-	-	-	-	-	-	-	2	-
24CSE363.2	3	-	-	-	-	-	-	-	-	-	-	2	-
24CSE363.3	-	3	-	-	--	-	-	-	-	-	-	3	2
24CSE363.4	-	-	3	-	2	-	-	-	-	-	-	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic Command Line Interface skills • Knowledge about file systems • A Github/ Gitlab account.	2	NA
	PART-A		
1a	Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message. Also add files that need not be tracked in to gitignore.	**2**	**24CSE363.1**
2a	Create a new branch named "feature-branch." Switch to the "main" branch. Merge the "feature-branch" into "main."	2	**24CSE363.1** **24CSE363.2**
3a	a. Make some changes to a tracked file in your repository. Use the appropriate Git command to view the changes made to the file before staging. b. Write the commands to stash your changes, switch branches, and then apply the stashed changes.	2	**24CSE363.1** **24CSE363.2**
4a	Write the command to merge "feature-branch" into "main" while providing a custom commit message for the merge.	2	**24CSE363.1** **24CSE363.2**
5a	a. Connect your local repository to a remote repository hosted on GitHub and push your local commits to it. b. Make a change in your GitHub repository online and then sync those changes to your local machine.	2	**24CSE363.2** **24CSE363.3**
6a	Clone a remote GitHub repository, verify its setup, make a small change to a file and commit it. Pull the latest updates from the remote to this cloned repository.	2	**24CSE363.2** **24CSE363.3**
	PART-B		
1b	Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.	**2**	**24CSE363.1** **24CSE363.2** **24CSE363.4**

2b	Write the command to display the last five commits in the repository's history.	2	**24CSE363.1 24CSE363.2 24CSE363.4**
3b	Write the command to cherry-pick a range of commits from "source-branch" to the current branch.	**2**	**24CSE363.1 24CSE363.2**
4b	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**	**24CSE363.2 24CSE363.4**
5b	Write the command to list all commits made by a specific author between a specific range of dates. (e.g., Author John between 2024-01-01 to 2024-12-31)	2	**24CSE363.2 24CSE363.3 24CSE363.4**
6b	Write the command to undo the changes introduced by the commit from a specific ID.	2	**24CSE363.1 24CSE363.2 24CSE363.4**

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

- Demo of Git rebasing concept: https://www.youtube.com/watch?v=fcy9refAhz0
- Git reset and reflog commands usage: https://www.datacamp.com/tutorial/git-reflog
- Git GUI using GitGUI /GitKraken/ SourceTree

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	5	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	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. Scott Chacon, Ben Straub**,** "Pro Git", Second Edition, Apress (Springer Nature), 2014. ISBN: 978-1484200773.

Web links and Video Lectures(e-Resources):

- Git documentation: https://git-scm.com/doc
- Github documentation: https://docs.github.com
- GitGUI using SourceTree: https://www.sourcetreeapp.com

Activity-Based Learning/Practical Based learning

- Project Presentation (Team/ Individual)

MICROSOFT VISIO			
Course Code	**24CSE364**	**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:

24CSE364.1	Describe proficiency in creating and editing professional diagrams such as flowcharts, organizational charts, and network diagrams using Microsoft Visio tools and templates.
24CSE364.2	Use shapes, connectors, and formatting features to design clear, visually structured diagrams that communicate complex information.
24CSE364.3	Evaluate diagramming best practices and customization techniques, including grouping, layering, themes, and text annotations, to enhance diagram clarity and consistency.
24CSE364.4	Formulate methods to export, share, and integrate Visio diagrams with external tools such as Excel or OneDrive, and to prepare diagrams for printing or presentation.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE364.1	3	3	3	3	1	-	-	-	-	-	1	3	-
24CSE364.2	3	3	3	3	2	-	-	-	-	-	1	3	-
24CSE364.3	3	3	3	3	2	-	-	-	-	-	1	3	-
24CSE364.4	3	3	3	3	2	-	-	-	-	-	1	3	-

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic Diagramming Concepts • Familiarity with Microsoft Office.	2	NA
	PART-A		
1	Create a new Visio diagram using a basic flowchart template and explore different stencils.	2	24CSE364.1
2	Implement customization of the Visio interface by enabling gridlines, rulers, and utilizing the shape search feature.	2	24CSE364.1
3	Develop a diagram by dragging and dropping various shapes from a stencil and connecting them using dynamic connectors.	2	24CSE364.1
4	Create a mini diagram with grouped shapes, align them properly, and adjust their order.	2	24CSE364.2
5	Apply different shape styles (color, fill, shadow) to multiple shapes.	2	24CSE364.2
6	Create a diagram and add text inside and outside shapes, format it using different fonts, and create a callout.	2	24CSE364.2

PART-B			
7	Construct a diagram and enhance its appearance by applying a theme and variant to the existing layout.	2	24CSE364.3
8	Create a simple organizational chart using employee data.	2	24CSE364.3
9	Develop a basic network diagram showing computers, routers, and switches.	2	24CSE364.3
10	Implement the steps to export a completed Visio diagram to PDF and image formats.	2	24CSE364.4
11	Develop a method to share and collaborate on a Visio file using OneDrive or SharePoint.	2	24CSE364.4
12	Create a Visio diagram that links to Excel data using the Data Visualizer feature.	2	24CSE364.4

PART-C

Beyond Syllabus Virtual Lab Content

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

1. **https://www.youtube.com/watch?v=jKc98gPybFs**
2. **https://www.youtube.com/watch?v=YfxCs1HG8QE&list=PLXP4h6BgzlN2y86dE-kZ6RfNX6d4SJxxv**
3. **https://www.youtube.com/watch?v=hthnvopfLCw**
4. **https://www.youtube.com/watch?v=jKc98gPybFs&t=546s**

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

- https://www.youtube.com/watch?v=gDkTSoLI-NY
- https://www.youtube.com/watch?v=C9rg8R5AI3w
- https://www.youtube.com/watch?v=b09dKHvu4-4
- https://www.youtube.com/watch?v=HODz1UrRSp4&list=PLWSweFpA2PEhLufMEPnEf-TFVxB2uCtws

BIO INSPIRED DESIGN AND INNOVATION			
Course Code	**24CSE365**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE365.1	Apply the biomimetics principles for real life challenges
24CSE365.2	Investigate novel bioengineering initiatives by evaluating design and development principles
24CSE365.3	Apply the bio computing optimization through research and experiential learning.
24CSE365.4	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
24CSE365.1	3	3	3	3	2	-	-	-	1	1	3	3	3
24CSE365.2	3	3	3	3	2	-	-	-	1	1	3	2	3
24CSE365.3	3	3	3	3	2	-	-	-	1	1	3	3	3
24CSE365.4	3	3	3	3	2	-	-	-	1	1	3	2	3

MODULE-1	**BIO-INSPIRED DESIGN AND ENGINEERING**	**24CSE365.1**	**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**	**24CSE365.2**	**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**	**24CSE365.3, 24CSE365.4**	**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**	**24CSE365.3**	**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**	**24CSE365.4**	**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 /Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same.
Text Book	Text Book 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	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

3) 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 class room
- Organizing Group wise discussions on sub topics
- Student presentations

UNIVERSAL HUMAN VALUES AND LIFE SKILLS			
Course Code	**24UHK37**	**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:

24UHK37.1	Understand the concept and significance of life skills and universal human values.
24UHK37.2	Develop Self-awareness and Self-management skills to promote personal growth.
24UHK37.3	Apply Critical and Creative thinking and ethical decision-making skills in various contexts.
24UHK37.4	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
24UHK37.1	-	-	-	-	-	3	1	2	-	2	2
24UHK37.2	-	-	-	-	-	1	2	3	1	2	3
24UHK37.3	-	-	-	-	-	3	1	2	1	3	2
24UHK37.4	-	-	-	-	-	2	2	3	2	2	1

MODULE-1	**Self-Awareness and Self-Management**	**24UHK37.1, 24UHK37.2**	**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**	**24UHK37.1, 24UHK37.3**	**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**	**24UHK37.3, 24UHK37.4**	**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**	**24UHK37.2, 24UHK37.3 24UHK37.4**	**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**	**24UHK37.3, 24UHK37.4**	**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

BASIC APPLIED MATHEMATICS-I
(Common to all Branches)

Course Code	**24DMAT31**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs. / Week	**2**	**Total Marks**	**50**
Credits	**0**	**Exam Hours**	**--**

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

24DMAT31.1	Know the principles of engineering mathematics through calculus
24DMAT31.2	Determine the power series expansion of a function
24DMAT31.3	Find the definite integrals with standard limits and also develop the ability to solve different types of differential equations
24DMAT31.4	Apply ideas from linear algebra in solving systems of linear equations and determine the Eigen values and Eigen vectors of a matrix

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24DMAT31.1	3	3	-	-	-	-	-	-	-	-	-
24DMAT31.2	3	3	-	-	-	-	-	-	-	-	-
24DMAT31.3	3	3	-	-	-	-	-	-	-	-	-
24DMAT31.4	3	3	-	-	-	-	-	-	-	-	-

MODULE-1	**DIFFERENTIAL CALCULUS**	24DMAT31.1 24DMAT31.2	**8 Hours**

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

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

MODULE-2	**PARTIAL DIFFERENTIATION**	24DMAT31.1	**8 Hours**

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

Text Book	Text Book 1: 5.4, 5.7,

MODULE-3	**INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS**	24DMAT31.3	**8 Hours**

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

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

MODULE-4	**LINEAR ALGEBRA-1**	24DMAT31.4	**8 Hours**

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

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

MODULE-5	**LINEAR ALGEBRA-2**	24DMAT31.4	**8 Hours**

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

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

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

RBT Levels		Marks Distribution		
		Theory Tests	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	-	-	-

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

- Contents related activities (Activity-based discussions)
  - Problem solving Approach
  - Organizing Group wise discussions on related topics
  - Seminars

Fourth Semester Syllabus

DISCRETE MATHEMATICS AND GRAPH THEORY (Common to AIML, CSE and CDS)			
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 Compositio and 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, Kruskal algorithm, 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	-	-
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	5
L2	Understand	5
L3	Apply	15
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	-	-	-	-	-	-	3	2
24CSK42.2	3	3	3	3	2	-	-	-	-	-	-	3	2
24CSK42.3	3	3	3	3	2	-	-	-	-	-	-	3	2
24CSK42.4	3	3	3	3	2	-	-	-	-	-	-	3	2
24CSK42.5	3	3	3	3	2	-	-	-	-	-	-	3	2
24CSK42.6	3	3	3	3	2	-	-	-	-	-	-	3	2

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	3	2
24CSLK42.2	3	3	3	3	2	-	-	-	-	-	2	3	2
24CSLK42.3	3	3	3	3	2	-	-	-	-	-	2	3	2
24CSLK42.4	3	3	3	3	2	-	-	-	-	-	2	3	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	2	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. 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.	2	24CSLK42.1
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:	2	24CSLK42.1

	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 helperthat 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.		
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**	2	24CSLK42.1

	▪ 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) o **Additional Attribute** – int typingSpeed (words per minute) o **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** o Create an abstract class Instrument containing a method void playNote(). 2. **Subclasses (hierarchical inheritance)** o Piano overrides playNote() to print "Piano: C-E-G chord". o Guitar overrides playNote() to print "Guitar: Strum on E minor". o Flute overrides playNote() to print "Flute: Sustained A note". 3. **Driver code** (OrchestraDemo) o Declare an Instrument[] array that holds one object of each subclass. o Iterate through the array and invoke playNote() on every element. o 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.	2	24CSLK42.3

	• 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".		
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	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**-**
L3	**Apply**	**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:

Atthe 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	2	-
24CSK43.3	3	3	2	2	2	-	-	-	-	-	2	2	-
24CSK43.4	3	3	2	2	-	-	-	-	-	-	2	2	-
24CSK43.5	3	3	2	2	-	-	-	-	-	-	2	2	-
24CSK43.6	3	3	2	2	2	-	-	-	-	-	1	2	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 3-3.2-3.6Chapter4- 4.1,4.2,4.3,4.4,4.6Chapter5-5.1-5.3 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

LINUX OPERATING SYSTEM 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 in a 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 andterminate 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 scheduling algorithm.	2	**24CSLK43.1**
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 and determining 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 Priorityandround-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 S S T F a n d LOOK disk schedulingalgorithm.	2	**24CSLK43.4**

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)
https://naim30.github.io/OS-virtual-lab/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – 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:

1) Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 10th Edition, 2018, ISBN978-1-118-06333-0.
2) Terrence Chan, Unix System Programming Using C++: Prentice Hall PTR, 1st Edition, ISBN 10: 0 13 3315622 / ISBN 13: 978 0133315622
3) W. Richard Stevens and Stephen A. Rago: Advanced Programming in the /UNIX Environment: Addison-Wesley, 2nd Edition, ISBN: 0321637739 / 978-0321637734

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	-	2
24CSK44.2	3	3	3	2	-	-	-	-	-	-	1	1	2
24CSK44.3	3	3	3	2	-	-	-	-	-	-	1	1	2
24CSK44.4	3	3	3	2	-	-	-	-	-	-	1	3	2
24CSK44.5	3	3	3	2	-	-	-	-	-	-	1	3	2
24CSK44.6	3	3	3	2	-	-	-	-	-	-	1	3	2

MODULE-1	**DATABASE FUNDAMENTALS AND DATABASE DESIGN**	**24CSK44.1, 24CSK44.2**	**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	1	2
24CSLK44.2	3	3	3	3	3	-	-	-	1	1	2	2	2
24CSLK44.3	3	3	3	3	3	-	-	-	1	1	2	2	2
24CSLK44.4	3	3	3	3	3	-	-	-	1	1	2	3	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)	2	24CSLK44.2

	BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date) LIBRARY_PROGRAMME (Programme_id, Programme_Name, Address) 1. Insert at least 5 records for each table. Add appropriate database constraints 2. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Program, etc. 3. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 4. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 5. Create a view of all books and its number of copies that are currently available in the Library.		
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.

Professional Elective Course-I (3:0:0:0)	
24CSE451	Knowledge Engineering
24CSE452	Introduction to Cloud Computing and Virtualization
24CSE453	Software Testing and Automation
24CSE454	Computer Graphics
24CSE455	Fundamentals of Information Security
24CSE456	Entrepreneurship and Innovation Management

KNOWLEDGE ENGINEERING

Course Code	**24CSE451**	**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:

24CSE451.1	Explain the fundamentals of Knowledge Engineering, the DIKW pyramid, and Semantic Web technologies
24CSE451.2	Design ontologies using OWL, RDF, and Protégé to represent domain knowledge.
24CSE451.3	Construct and query knowledge graphs using RDF, SPARQL, and Neo4j.
24CSE451.4	Apply reasoning techniques (deductive, inductive, abductive) and handle uncertainty using probabilistic models.
24CSE451.5	Implement rule-based reasoning and inference mechanisms using ontologies and rule sets.
24CSE451.6	Integrate Machine Learning techniques with knowledge-based systems for rule learning and knowledge discovery.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE451.1	**3**	**2**	**2**	1	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**
24CSE451.2	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**-**
24CSE451.3	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**
24CSE451.4	**3**	**3**	**3**	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**1**	**3**	**3**
24CSE451.5	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**1**	**1**	**-**	**1**	**3**	**3**
24CSE451.6	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**3**	**3**

MODULE-1	**Knowledge Representation and Reasoning under Uncertainty**	**24CSE451.1, 24CSE451.4**	**8 Hours**

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – **Baconian Probability – Fuzzy Probability – Uncertainty methods** – Evidence-based reasoning – Intelligent Agent – **Mixed-Initiative Reasoning** – Knowledge Engineering.

Self-study / Case Study / Applications	Building a small health assistant chatbot. When someone types "I have fever and cough," the chatbot should guess what illness it might be—like flu or cold. But since it's not sure, it shows different chances, like "70% flu, 30% cold." If the person adds "loss of smell," the chatbot changes its guess. This helps you learn how systems handle incomplete or uncertain information.
Text Book	1.2, 1.3, 1.4, 1.6, 2.5, 2.6

MODULE-2	**Knowledge Engineering Methodologies and Design Approaches**	**24CSE451.1, 24CSE451.2**	**8 Hours**

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

Self-study / Case Study / Applications	Designing a simple career helper for students. It asks questions like "Do you enjoy coding?" or "Are you good at maths?" and then suggests a suitable career like engineer or designer. Even if the student skips a few questions, the system still gives suggestions. This helps you learn how smart systems are designed step by step using logical thinking.
Text Book	3.1, 3.3, 3.4

MODULE-3	**Ontology Modeling and Semantic Knowledge Structuring**	**24CSE451.2, 24CSE451.3**	**8 Hours**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.
Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

Self-study / Case Study / Applications	Create a mini knowledge model of a grocery store. You list items like Milk, Apple, and Bread. Then, you group them under categories like Dairy or Fruits. You also add details like price or expiry date. This case helps you understand how to organize information so that computers can understand and use it.		
Text Book	5.2, 5.3, 5.5–5.10, 6.1–6.4		
MODULE-4	**Rule-Based Inference and Ontological Reasoning**	**24CSE451.4, 24CSE451.5**	**8 Hours**
Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.			
Self-study / Case Study / Applications	Design a smart light system for your home. The rule is simple: if it's dark and someone enters the room, the light should turn on. If no one is there for 10 minutes, it turns off. You also think of what happens if the motion sensor doesn't work. This teaches you how computers use rules to make decisions.		
Text Book	7.1–7.6		
MODULE-5	**Machine Learning for Rule Induction and Knowledge Discovery**	**24CSE451.5, 24CSE451.6**	**8 Hours**
Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.			
Self-study / Case Study / Applications	Make a small tool to predict if a student will pass or fail. For example, if a student has more than 80% attendance and good marks, it says "Pass." Later, it improves its rules by learning from other student results. This helps you understand how machines can learn from data and improve over time.		
Text Book	8.1, 8.3, 8.4, 9.1, 9.2, 9.4, 9.10		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	**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**	**10**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**10**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum – *Knowledge Engineering: Building Cognitive Assistants for Evidence-Based Reasoning* (Cambridge University Press, 2016)

Reference Books:

1. Knowledge engineering and expert systems, Rastogi, P. N, Business Promotion Bureau, New Delhi, 1994.
2. Domain-Specific Knowledge Graph Construction, Mayank Kejriwal, Springer, 2019.
3. Knowledge Graphs -Methodology, Tools and Selected Use Cases, Dieter Fensel, Umutcan Simsek, Springer, 2019.
4. Paul Groth, Frank van Harmelen, Rinke Hoekstra. A Semantic Web Primer, Third Edition, MIT press; 2012.
5. Semantic Web concepts, technologies and applications, K K Breitman, M A Casanova, W Truszkowski, Springer, 2006.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106140
- https://www.youtube.com/watch?v=l0PZhqmTwfM&list=PL6DEHvciXKeUx4P32B3hKMK1t6mC8RhsW
- https://www.youtube.com/watch?v=HZGCoVF3YvM
- https://www.youtube.com/watch?v=cIyBZ15Q65I

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

- Self-study to explore Knowledge graphs and ontologies
- Case Study- Designing Knowledge graphs

INTRODUCTION TO CLOUD COMPUTING AND VIRTUALIZATION			
Course Code	**24CSE452**	**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:

24CSE452.1	Understand the fundamental concepts that form the basis of cloud computing.
24CSE452.2	Utilize virtualization, containerization, and cloud resource management strategies to address real-world scalability issues.
24CSE452.3	Leverage the knowledge to design, deploy, and scale cloud applications using PaaS, DBaaS, and microservices.
24CSE452.4	Effectively use and manage cloud cost optimization tools and services.
24CSE452.5	Design detailed strategies for implementing a successful cloud migration.
24CSE452.6	Implement cost-saving strategies in cloud environments.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE452.1	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE452.2	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE452.3	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE452.4	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE452.5	3	3	3	3	2	-	-	-	1	1	1	3	3
24CSE452.6	3	3	3	3	2	-	-	-	1	1	**1**	3	3

MODULE-1	**Introduction to Cloud Computing and Virtualization**	**24CSE452.1**	**8 Hours**

Definition of Cloud Computing, Historical Evolution, Key Benefits and Advantages, Cloud Service Models (IaaS, PaaS, SaaS), Cloud Deployment Models (Public, Private, Hybrid, Community), and an Overview of Leading Cloud Providers such as AWS, Azure, Google Cloud, and others.

Self-study / Case Study / Applications	Case Studies: Real-world examples of cloud adoption 1. Netflix 2. Airbnb 3. Dropbox
Text Book	Text Book 1: 1-4

MODULE-2	**Cloud Infrastructure and Virtualization**	**24CSE452.2**	**8 Hours**

Virtualization Technologies and Concepts, Hypervisors and Virtual Machines (VMs), Containers and Containerization Tools (Docker, Kubernetes), IaaS Providers, Cloud-Based Virtual Resource Management, Scalability, and Elasticity.

Self-study / Case Study / Applications	Lab Exercises: Creating and Managing Virtual Machines in the Cloud Lab 1: Creating a Virtual Machine Lab 2: Managing Virtual Machines Lab 3: Creating Custom Images Lab 4: Launching VMs from Custom Images Lab 5: Managing Snapshots and Backups
Text Book	Text Book 1: 5-7

MODULE-3	**Cloud Services and Platform as a Service (PaaS)**	**24CSE452.3**	**8 Hours**

Overview of Platform as a Service (PaaS), Leading PaaS Providers (e.g., Heroku, Google App Engine), Building, Deploying, and Scaling Cloud Applications, Introduction to Database as a Service (DBaaS), Microservices Architecture, and Serverless Computing..

Self-study / Case Study / Applications	Case Studies: Building and Deploying Web Applications in the Cloud E-Commerce Website Migration to AWS - Scenario: Serverless Web App on Google Cloud Platform - Scenario
Text Book	Text Book 1: 11,12

MODULE-4	Cloud Cost Management and Optimization	24CSE452.4 24CSE452.6	8 Hours
Cloud Cost Management – Understanding Cost Structures, Comparing Total Cost of Ownership (TCO) with Cloud Expenses, Significance of Cost Optimization, Tracking and Analyzing Cloud Costs through Billing and Allocation, Utilizing Cost Dashboards and Reports, Identifying Key Cost Drivers and Anomalies, Implementing Cost Optimization Strategies such as Rightsizing of VMs, Storage, and Databases, and Exploring Cloud Cost Management Tools (e.g., AWS Cost Explorer, Azure Cost Management).			
Self-study / Case Study / Applications	Lab Experiment: Cost Analysis and Optimization Objective: Learn how to analyze cloud costs and optimize them for efficiency Lab Experiment: Data Transfer Cost Management Objective: Explore cost management strategies for data transfer in the cloud.		
Text Book	Text Book 1: 19, 20		
MODULE-5	**Cloud Migration and Management**	**24CSE452.5**	**8 Hours**
Cloud Migration Strategies – Rehosting, Refactoring, and Rearchitecting; Planning and Executing Cloud Migrations; Cost Optimization in Cloud Environments; Cloud Governance and Management Tools; Cloud Service Management Platforms (e.g., AWS Management Console, Azure Portal); and Emerging Trends and Innovations in Cloud Computing.			
Self-study / Case Study / Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same. **1.** Dropbox's Migration to AWS **2.** Netflix's Cloud Adoption with AWS **3.** Airbnb's Cloud Transition with AWS		
Text Book	Text Book 1: 21, 22		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	AAT1 (NPTEL)
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	10
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) Cloud Computing: Principles and Paradigms, by Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Wiley, 2011.
2) Virtualization Essentials, Matthew Portnoy and David K, Wiley, 2016.

Reference Books:

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

Web links and Video Lectures (e-Resources):

- **https://docs.aws.amazon.com/**
- **https://cloud.google.com/docs**
- **https://docs.microsoft.com/en-us/azure/**
- **https://cloudcomputing-news.net/**
- **https://github.com/topics/cloud-computing**

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

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

SOFTWARE TESTING AND AUTOMATION			
Course Code	**24CSE453**	**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:

24CSE453.1	Discuss the basic concepts of software testing and the need for software testing.
24CSE453.2	Explain the significance of various software testing in the development of software.
24CSE453.3	Utilize software testing principles to choose the best testing approach.
24CSE453.4	Build test cases for any software by evaluating the appropriate testing approach.
24CSE453.5	Apply the software automation process to test the web application.
24CSE453.6	Automate the software testing using Selenium and TestNG.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE453.1	3	3	2	1	-	-	-	-	-	2	1	3	3
24CSE453.2	2	3	1	1	1	-	-	-	-	2	2	1	2
24CSE453.3	2	2	1	3	1	-	-	-	-	1	2	1	3
24CSE453.4	2	1	3	2	1	-	-	-	-	1	3	3	3
24CSE453.5	2	2	1	3	2	-	-	-	-	1	1	3	2
24CSE453.6	2	2	2	2	2	-	-	-	-	1	1	1	1

MODULE-1	**FOUNDATIONS OF SOFTWARE TESTING**	**24CSE453.1**	**8 Hours**

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V- model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

Text Book	Textbook 2:Ch1

MODULE-2	**Functional Testing**	**24CSE453.2, 24CSE453.3**	**8 Hours**

Boundary Value Testing - Boundary value analysis, Robustness testing, Worst-case testing, Special Value Testing, Examples, Random Testing, Guidelines.
Equivalence Class Testing - Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations,
Decision Table Based Testing - Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

Text Book	Textbook 1: Ch. 5, 6, 7

MODULE-3	**Structural Testing**	**24CSE453.3, 24CSE453.4**	**8 Hours**

Structural Testing: Overview, Statement testing, Program testing, Condition testing,
Path testing - DD paths, Test coverage metrics, Basis path testing, guidelines and observations,
Dataflow testing: Definition-Use testing, Slice-based testing, Guidelines and observations

Text Book	Textbook 1: Ch 9,10 Textbook 2:Ch. 6.2.1, 6.2.4

MODULE-4	**Integration and System Testing**	**24CSE453.3, 24CSE453.4**	**8 Hours**

Levels of Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing.
Integration Testing: A closer look at the SATM system, Decomposition-based, call graph-based, Pathbased integrations

Text Book	Textbook 1: Ch. 12 & 13.1,13.2,13.3,13.4		
MODULE-5	**TEST AUTOMATION AND TOOLS**	**24CSE453.5, 24CSE453.6**	**8 Hours**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

Text Book	Text Book 3: Chapter 13.

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Paul C. Jorgensen: Software Testing, A Craftsman‟s Approach, 3rd Edition, Auerbach Publications, 2008.
2. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012.
3. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition 2018

Reference Books:

1. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
2. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007.
3. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
4. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
5. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015

Web links and Video Lectures (e-Resources):

1.https://nptel.ac.in/courses/106/105/106105150/
2.https://onlinecourses.nptel.ac.in/noc19_cs71/preview
3.https://www.youtube.com/watch?v=OGImfxO2TEU&t=s
4.https://www.youtube.com/watch?v=Q50ZyydS7pI

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

- Seminar/Poster Presentation
- Mini Project
- Case study
- Learn by Doing

COMPUTER GRAPHICS

Course Code	**24CSE454**	**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:

24CSE454.1	Understand the fundamentals of computer graphics, graphics systems, and color models used in image representation
24CSE454.2	Apply the algorithms for line, circle generation, and basic geometric transformations in 2D
24CSE454.3	Apply window-to-viewport mapping and perform clipping operations using standard algorithms
24CSE454.4	Understanding of 3D transformations, projection techniques, and viewing pipeline
24CSE454.5	Analyze illumination models and shading techniques for realistic rendering
24CSE454.6	Analyze model curves using Bezier and B-spline techniques for graphics and animation applications.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE454.1	3	3	2	1	2	1	1	-	1	-	2	3	2
24CSE454.2	3	3	2	1	2	1	1	-	1	-	2	3	2
24CSE454.3	3	3	2	1	2	1	1	-	1	-	2	3	2
24CSE454.4	3	3	2	1	2	1	1	-	1	-	2	3	2
24CSE454.5	3	3	2	1	2	1	1	-	1	-	2	3	2
24CSE454.6	3	3	2	1	2	1	1	-	1	-	2	3	2

MODULE-1	**INTRODUCTION & GRAPHICS BASICS**	**24CSE454.1**	**8 Hours**

Fundamentals of Computer Graphics and applications, Raster vs. random-scan display architecture, Graphics pipeline overview, Line drawing algorithms: DDA, Bresenham , Circle generation: Midpoint algorithm

Self-study	1.A **mobile sketching app** must balance speed and battery life. Which line drawing algorithm would you use (DDA or Bresenham)? Justify your choice with trade-offs. 2. In **autonomous vehicles**, sensor data is continuously converted into visuals. Explain how the **graphics pipeline** can be adapted for real-time rendering. 3. Suppose you are developing a **CAD tool for architects**. Explain how each algorithm (DDA, Bresenham, midpoint circle) will support different drawing requirements in the software.
Text Book	Text Book 1: Ch 1,2

MODULE-2	**2D GRAPHICS & TRANSFORMATIONS**	**24CSE454.2 24CSE454.3**	**8 Hours**

Polygon drawing basics , Polygon filling: scan-line and boundary-fill methods , 2D transformations: translation, rotation, scaling , Composite transformations and homogeneous coordinates, Window-to-viewport mapping

Case-study	1.You are creating a 2D animation of a walking character. Explain how composite transformations (translation + rotation + scaling) are combined to simulate realistic motion.
Text Book	Text Book 1: Ch 3,4,6

MODULE-3	**CLIPPING & 3D BASICS**	**24CSE454.3 24CSE454.4**	**8 Hours**

Line clipping: Cohen–Sutherland algorithm, Polygon clipping: Sutherland–Hodgeman, 3D transformations: translation, rotation, scaling, Introduction to projections: parallel and perspective.

Case Study	1. Suppose you are designing a **CAD system**. Large complex shapes may need to be cropped to a selected viewport. Explain how **Sutherland–Hodgeman polygon clipping** can be used and its limitations.
Text Book	Text Book 2 : Ch 6,7

MODULE-4	**ILLUMINATION & SURFACE VISIBILITY**	**24CSE454.5**	**8 Hours**

Basics of color models: RGB and HSV , Illumination models: ambient, diffuse, specular , Shading techniques: Flat and Gouraud shading , Hidden surface removal: Z-buffer method.			
Self-study	Study how Z-buffering is applied in augmented reality applications to correctly overlay virtual objects on real-world video feeds. Discuss challenges in real-time rendering.		
Text Book	Text Book 1: Ch 13, 14, 15		
MODULE-5	**CURVES & ANIMATION**	**24CSE454.6**	**8 Hours**
Bezier curves basics : Definition , Properties, Bezier curve Equation , B-spline curves introduction, Animation principles: keyframe and double buffering , Fractals overview (e.g., Koch curve).			
Application	Imagine you are developing a 2D animation software for architects to design curved structures like arches and bridges. How would you apply Bezier curves and keyframe animation together to model and animate these designs smoothly?		
Text Book	Text Book 1: Ch 11, 12 ,16		

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

SEE Assessment Pattern(50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Donald Hearn, M. Pauline Baker, Warren Carithers, *Computer Graphics with OpenGL*, 4th Edition, Pearson, 2020.
2. F.S. Hill Jr. and Stephen Kelley, *Computer Graphics Using OpenGL*, 3rd Edition, Pearson, 2021.

Reference Books:

1. John F. Hughes et al., *Computer Graphics: Principles and Practice*, 3rd Edition, Addison-Wesley, 2018.
2. Peter Shirley, Michael Ashikhmin et al., *Fundamentals of Computer Graphics*, 5th Edition, CRC Press, 2021.
3. James D. Foley, Andries van Dam et al., *Introduction to Computer Graphics*, Addison-Wesley, 2nd Edition (still widely used), 2019 reprint.

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/106/101/106101007/**
- **https://nptel.ac.in/courses/106/102/106102065/**
- **https://nptel.ac.in/courses/106/104/106104046/**

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

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

FUNDAMENTALS OF INFORMATION SECURITY			
Course Code	**24CSE455**	**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:

24CSE455.1	Understand the key principles of information security including confidentiality, integrity, and availability
24CSE455.2	Identify and classify information assets and perform risk assessments
24CSE455.3	Understand and apply security policies, standards, and governance roles
24CSE455.4	Apply technical and organizational controls for securing systems
24CSE455.5	Analyze real-world threats including malware, social engineering, and phishing.
24CSE455.6	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
24CSE455.1	3	3	3	2	2	-	-	-	-	-	2	3	2
24CSE455.2	3	3	3	2	2	-	-	-	-	-	2	3	2
24CSE455.3	3	3	3	2	2	-	-	-	-	-	2	3	2
24CSE455.4	3	3	3	2	2	-	-	-	-	-	2	3	2
24CSE455.5	3	3	3	2	2	-	-	-	-	-	2	3	2
24CSE455.6	3	3	3	2	2	-	-	-	-	-	2	3	2

MODULE-1	**INTRODUCTION TO INFORMATION SECURITY**	**24CSE455.1**	**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**	**24CSE455.2, 24CSE455.3**	**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

Application:	**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**	**24CSE455.3**	**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			
Self-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**	**24CSE455.4**	**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			
Case Study	**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**	**24CSE455.5, 24CSE455.6**	**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)

RBT Levels	Exam Marks Distribution (50)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	-

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

1 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.

2. Password Cracking Simulation: Use tools like Cain & Abel or online hash crackers to demonstrate password vulnerabilities (in a controlled virtual environment).

3. Security Policy Drafting Exercise: In teams, students draft sample *Acceptable Use Policies* or *Email Usage Policies* for a fictional organization.

4. Threat Modeling Workshop: Using a basic system diagram, have students identify assets, threats, vulnerabilities, and propose mitigation strategies.

5. Risk Matrix Activity: Each group builds a risk matrix using Likelihood vs. Impact for given scenarios (e.g., ransomware, phishing).

6. Incident Response Drill: Simulate a classroom security breach and assign students roles: CISO, Analyst, Communicator, Recovery Head. Let them respond and document actions.

7. 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	**24CSE456**	**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:

24CSE456.1	Explain the nature, importance, and basic functions of management.
24CSE456.2	Identify various types of innovation and their impact on business models.
24CSE456.3	Develop skills in idea generation, feasibility analysis, and business plan creation.
24CSE456.4	Identify key financing sources and government support for new ventures.
24CSE456.5	Apply knowledge of intellectual property rights, including patents and copyrights, in innovation management.
24CSE456.6	Implement entrepreneurial principles to real-world scenarios 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
24CSE456.1	1	2	2	-	-	-	-	-	-	-	-	2	-
24CSE456.2	1	2	2	2	-	-	-	-	-	-	-	2	-
24CSE456.3	-	-	2	2	1	2	-	-	-	-	-	3	2
24CSE456.4	1	-	2	2	1	2	-	-	-	-	-	3	2
24CSE456.5	1	2	2	2	-	3	-	-	-	-	-	3	3
24CSE456.6	-	-	-	3	-	3	-	-	-	-	-	3	3

MODULE-1	**Introduction to Management, Innovation, and Entrepreneurship**	**24CSE456.1**	**8 Hours**

Management Fundamentals**:** Nature and Functions of Management, Importance, Definition, Management Functions, Levels of Management, Management as a Science, Art & Profession, Innovation and Creativity**:** Introduction to Innovation and Creativity, Innovation in Current Environment, Types of Innovation, Entrepreneurship Basics: Definition of Entrepreneur, Importance of Entrepreneurship, Concepts of Entrepreneurship, Characteristics of a Successful Entrepreneur, Classification of Entrepreneurs

Self-study	Analyze real-world examples of innovative companies and their entrepreneurial journeys.
Text Book	Text Book: 1 Chapters: 1,2,3 Pages (1-65) NPTEL Course: Innovation, Business Models and Entrepreneurship

MODULE-2	**Business Models and Idea Generation**	**24CSE456.2**	**8 Hours**

Business Models: Meaning, Designing, Analyzing and Improvising Business Models ,Idea Generation and Feasibility Analysis**:** Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities, Challenges of Innovation: Steps of Innovation Management, Idea Management System, Design Thinking and Entrepreneurship

Applications	Develop a business model canvas for a new product or service idea.
Text Book	Text Book: 2 Chapters: 6,7,8; NPTEL Course: Innovation, Business Models and Entrepreneurship

MODULE-3	**Entrepreneurial Development and Financing**	**24CSE456.3, 24CSE456.4**	**8 Hours**

Entrepreneurial Development Models: Entrepreneurial Development Cycle, Problems Faced by Entrepreneurs and Capacity Building for Entrepreneurship Family Business: Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various Types of Family Businesses Financing New Ventures: Financial Opportunity Identification; Banking Sources; Nonbanking Institutions and Agencies; Venture Capital - Meaning and Role in Entrepreneurship; Government Schemes for Funding Business

Case Study	Research government schemes and policies supporting entrepreneurship in India.
Text Book	Text Book: 2 Chapters: 4,5,7,8

MODULE-4	Innovation Management and Intellectual Property	24CSE456..5	8 Hours

Technological Innovation Management: Technology Innovation Process, Technological Innovation Management Planning, Technological Innovation Management Strategies, Technology Forecasting Management of Innovation: Creation of IPR, Types of IPR, Patents and Copyrights, Patents in India. Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences

Self-study	Analyze a patent document and understand its key components.
Text Book	Text Book: 3 Chapters: 20; NPTEL Course: Innovation, Business Models and Entrepreneurship

MODULE-5	Advanced Topics and Emerging Trends in Entrepreneurship	24CSE456..6	8 Hours

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance Sustainability Innovation and Entrepreneurship: Innovation Sustainable Conditions, Innovation: Context and Pattern, SME's strategic involvement in sustainable development, Future Markets and Innovation Needs: Business Models and Value Proposition, Business Model Failure: Reasons and Remedies, Incubators: Business Vs Technology, Managing Investor for Innovation, Future Markets and Innovation Needs for India

Case Study	Research and present on a current trend in social entrepreneurship or sustainable business models.
Text Book	Text Book: 1 Chapter: 3 NPTEL Course: Innovation, Business Models and Entrepreneurship

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

AAT1 – Free online course
AAT2- Case study/Group discussion

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. P.C Tripathi, P.N Reddy, Principles of Management, McGraw Hill Education, 7th Edition, 2017. ISBN-13:978-93-5260-5354.

2. Poomima M Charantimath, Entrepreneurship Development Small Business Enterprises, Pearson Education, 2008, ISBN 978-81-7758-260-4.

3. Vasant Desai, Dynamics of Entrepreneurial Development and Management, HPH, 2007, ISBN: 978- 81-8488-801-2.

4. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, Entrepreneurship, 5th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.- New Delhi, 2012.

5. Rishikesha T. Krishnan and Vinay Dabholkar, 8 Steps To Innovation : Going From Jugaad To Excellence.

Reference Books:

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

2. HBS series on Innovation and Entrepreneurship.

Web links and Video Lectures (e-Resources):

- NPTEL Course: Innovation, Business Models and Entrepreneurship (IIT Roorkee) https://onlinecourses.nptel.ac.in/noc21_mg63/preview *
- Various online platforms like YouTube, Udemy, and edX offer tutorials and courses on Entrepreneurship and Innovation Management.

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

- Case Study Analysis of successful and failed startups.
- Guest lectures from entrepreneurs and innovators.
- Group discussions on current trends in innovation and entrepreneurship.
- Developing a detailed business plan for a new venture.
- Analyzing intellectual property strategies of various companies.
- Organizing Group wise discussions on issues.

Ability Enhancement Course–IV (0-0-1-0)	
24CSE461	**IoT Programming**
24CSE462	**Automated Software Testing with Tosca**
24CSE463	**Data Visualization with Python**
24CSE464	**UI / UX Design**
24CSE465	**Programming in C++**

IOT PROGRAMMING			
Course Code	**24CSE461**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

24CSE461.1	Understand functionalities of various single board embedded platforms fundamentals
24CSE461.2	Understand interfacing IoT devices with Arduino
24CSE461.3	Apply Arduino interfacing to create simple application
24CSE461.4	Implement interfacing of various sensors with Arduino.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE461.1	3	1	1	-	3	-	-	-	-	-	3	3	3
24CSE461.2	3	1	1	-	3	-	-	-	-	-	3	3	3
24CSE461.3	3	3	3	3	3	-	-	-	-	-	3	3	3
24CSE461.4	3	3	3	3	3	-	-	-	-	-	3	3	3

Pgm. No.	List of Programs	Hours	COs
	PART-A		
1	To interface LED / Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED / Buzzer for 1 sec after every 2 seconds.	2	24CSE461.1
2	To interface Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED at sensor detection.	2	24CSE461.1
3	To interface smoke sensor with Arduino/Raspberry Pi and write a program to turn on alarm when smoke is detected.	2	24CSE461.1
4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	2	24CSE461.2
5	To interface TCS3200 Color Sensor with Arduino to detect the colors and display the same.	2	24CSE461.2
6	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.	2	24CSE461.2
	PART-B		
7	To interface ultrasonic sensor with Arduino/Raspberry Pi and write a program to display the distance of the obstacle.	2	24CSE461.3
8	To interface float sensor to detect water level in over head tanks and warn the overflow using Arduino/Raspberry PI with an LED	2	24CSE461.3
9	To interface ADXL335 accelerometer with Arduino/RaspberryPI to detect the various orientation and display it on serial monitor.	2	24CSE461.3

10	Create an application that has three LEDs (Red, Green and white). The LEDs should follow the cycle (All Off, Red On, GreenOn, WhiteOn) for each hand movement (use Ultrasonic sensor).	2	24CSE461.3
11	To interface soil moisture sensor to display the quality of soil moisture values using Arduino/RaspberryPI	2	24CSE461.3
12	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to cloud.	2	24CSE461.4

PART-C

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

1. Develop a native application that uses GPS location information. https://gr-solution.blogspot.com/2015/12/develop-native-application-that-uses.html
2. Develop a mobile application to send an email. https://www.geeksforgeeks.org/how-to-send-an-email-from-your-android-app/
3. Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice. https://www.geeksforgeeks.org/edittext-widget-in-android-using-java-with-examples/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

1) Dawn Griffiths and David Griffiths, "Head First Android Development: A Brain-Friendly Guide", Publisher: O'Reilly Media, Inc., 2017, ISBN- 97814919740562

2) Erik Hellman, "Android Programming: Pushing the Limits", Publisher: Wiley, 2013 ISBN: 978-1-118-71737-0

3) Pradeep Kothari, " Android Application Development Black Book" Publisher: Dream tech Press, 2014, ISBN:9789351194095

AUTOMATED SOFTWARE TESTING WITH TOSCA			
Course Code	**24CSE462**	**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:

24CSE462.1	Understand the features, components, and benefits of the Tosca platform
24CSE462.2	Understand the Test case design, Test execution and Test data management
24CSE462.3	Apply the concepts of Test automation using Tosca
24CSE462.4	Implement the Test scenario development for real world applications

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE462.1	3	1	1	-	2	-	-	-	-	-	3	3	3
24CSE462.2	3	1	1	-	2	-	-	-	-	-	3	3	3
24CSE462.3	3	3	3	3	2	-	-	-	-	-	3	3	3
24CSE462.4	3	3	3	3	2	-	-	-	-	-	3	3	3

Pgm. No.	List of Programs	Hours	COs
	PART-A		
1	**Installation of Tosca**: Installation and Setup, Tosca Commander, Tosca Executor, Tosca XScan (Tosca Wizard) and Test Repository **Functional acceptance testing**: Tosca to perform functional acceptance tests for web applications (Hint: Web Application of your choice)	2	24CSE462.1
2	**Scanning and creating a module:** Create a basic test case and Object Identification methods – By properties, By Anchor, By image, By Index	2	24CSE462.1
3	**Buffer Operations**: Setting buffer, Deleting buffer, Partial buffer, Expression evaluator and Process Operations.	2	24CSE462.1
4	**Window Operations:** Send Keys, Window Operations using MATH operation to perform calculations, such as finding the minimum or rounding a value.	2	24CSE462.2
5	**Record and Playback:** Enable recording in the Execution Recorder settings, record your interactions with the application, Edit the recorded steps and Play back the recording.	2	24CSE462.2
6	**Designing Test cases**: Data creation in Test Case design and Conversion of Mapping and Templates.	2	24CSE462.2
	PART-B		
7	**Data-Driven Test with Excel-**Read user data from Excel, Perform login or form-fill for each row, Validate results dynamically	2	24CSE462.3
8	**E-Commerce Cart Test Case**-Search for an item, Add item to cart, Validate price and item count in cart	2	24CSE462.3

9	**Synchronization:** Wait On, Default Settings, Static Wait, Timeout, TBox Wait and Sf Wait for Busy Indicator	2	24CSE462.3
10	**Reusable Test Step block:** Create a Reusable Test Step Block and Creating and Using Libraries.	2	24CSE462.3
11	**Conditional statements:** create conditional statements in Tosca to run test steps	2	24CSE462.4
12	Build Test suit with suitable application and complete end to end automation process.	2	24CSE462.4

PART-C

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

1. API Testing with TOSCA- Introduction to API Testing, API Modules Creation, Request Response Validation
2. https://medium.com/%40QA-initi/free-resources-to-learn-tosca-60286725fb60
3. https://youtu.be/PBLqTF5Mk-g?si=07TO4m0Q8a0qrout

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books

1) **Tricentis**, *"TOSCA Automation Tool – Official Documentation"* Publisher: Tricentis GmbH (Online Resource)

2) **Paul C. Jorgensen**, *"Software Testing: A Craftsman's Approach"*, Publisher: Auerbach Publications, 4th Edition ISBN: 9781466560680,2021

3) **Aditya Garg**, *"Software Testing with Tricentis Tosca"*, Publisher: BPB Publications, 2021 ISBN: 9789389898869

DATA VISUALIZATION WITH PYTHON			
Course Code	**24CSE463**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE463.1	Demonstrate the use of IDLE or any IDE to create Python applications. functions of matplotlib for drawing plots.
24CSE463.2	Analyze and perform exploratory data analysis (EDA) and interpret the results to derive insights with the use of Python.
24CSE463.3	Apply data visualization library functions of Matplotlib, Seaborn, Plotly for creating plots and using real-world datasets including time-series and maps.
24CSE463.4	Evaluate different Python tools, libraries, and environments for data visualization based on their suitability and effectiveness for specific tasks.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE463.1	3	3	3	3	2	-	-	-	-	-	3	3	
24CSE463.2	3	3	3	3	2	-	-	-	-	-	3	3	
24CSE463.3	3	3	3	3	2	-	-	-	-	-	3	3	
24CSE463.4	3	3	3	3	2	-	-	-	-	-	3	3	

Exp. No.	List of Experiments	Hours	COs
	Prerequisite		
	Basic foundation in statistics, data manipulation using software tools, python programming, types of plotting	**2**	**NA**
	PART-A		
1	a. Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. Write a Python program to find the string similarity between two given strings	2	**24CSE463.1**
2	a. create a user defined data frame. Write a Python program to Demonstrate how to Draw a Histogram Plot, pie chart using Matplotlib	2	**24CSE463.1**
3	a. Write a python code to display an Image in Grayscale using Matplotlib library functions. b. Write a python code to create scatter plots, increase size of scatter points and add legends using matplotlib.	2	**24CSE463.1**
4	Create a python code for performing exploratory data analysis for any standard data set.	2	**24CSE463.2**
5	Use box plot and heatmaps functions to derive insights from a given dataset	2	**24CSE463.2**

6	Write a Python program for plotting different types of plots using Seaborn	**2**	**24CSE463.3**
PART-B			
7	Write a Python program for customizing titles, colors, figure size and aspect ratio using Seaborn library	**2**	**24CSE463.3**
8	Write a Python program for time series visualization of the stock market data for identifying high stock prices, seasonality, etc. using plotly library.	**2**	**24CSE463.3**
9	Write a Python program for creating Maps using Plotly Libraries	**2**	**24CSE463.3**
10	Write a python program for plotting moving average for stock market prices using appropriate dataset.	2	**24CSE463.4**
11	Create an interactive visualization for components like dropdown menus, sliders, or buttons to allow users to filter or modify the displayed data.	2	**24CSE463.4**
12	Write a python program using plotly functions to create scatter plot on the world map for the earthquakes occurred.	2	**24CSE463.4**

PART-C

Beyond Syllabus Virtual Lab Content

1. https://www.bu.edu/metit/services/client-technology/virtual-lab/virtual- labs- tutorials/vlabs-powerbi/
2. https://www.reddit.com/r/PowerBI/comments/bbewrd/microsoft_power_bi_free_ self_placed_learning_labs/?rdt=45871
3. https://powerbi.microsoft.com/en-in/blog/tag/virtual-lab/

CIE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Text Book:

1. Reimagining Data Visualization Using Python -by Seema Acharya, 2022 edition, Wiley publications, ISBN-978-9354641336

Reference Book:

1. Data Visualization in Python- by Daniel Nelson, 2021 edition, Amazon publishing house, ISBN-979- 8521342877

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=q68Qundmans**
- **https://www.youtube.com/watch?v=OOLlVlleaN4**
- **https://www.youtube.com/watch?v=a9UrKTVEeZA**

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

- **Data Exploration and Visualization Workshop:**
  - Explore using data analytics tools like Python and libraries like Pandas and Matplotlib. Practice loading, cleaning, and visualizing data.
- **Case Studies:**
  - Present real-world data analytics challenges or case studies. Apply your knowledge to solve these problems using appropriate tools and libraries.
- **Interactive Coding Sessions:**
  - Involve interactive coding sessions where you can write code to perform data analysis tasks. Collaborate, ask questions, and debug together.
- **Expert Lectures:**
  - Attend expert's lecturers from the industry who can share their experiences using data analytics tools and libraries in practical scenarios. They can also provide insights into current trends.

UI/UX Design			
Course Code	**24CSE464**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE464.1	Understand core UI/UX design principles, usability standards, and accessibility.
24CSE464.2	Analyze and apply design thinking through case studies and mini sprints.
24CSE464.3	Create interactive, responsive prototypes using Figma.
24CSE464.4	Design and implement basic web interfaces using HTML and CSS following UI/UX best practices.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE464.1	3	3	3	3	2	-	-	-	-	-	-	3	-
24CSE464.2	3	3	3	3	2	-	-	-	-	-	-	3	-
24CSE464.3	3	2	3	3	2	-	-	-	-	-	-	3	-
24CSE464.4	3	2	3	3	2	-	-	-	-	-	-	3	-

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Basic understanding of design principles and Proficiency in using design software tools, as well as a creative mindset and an interest in user-centered design concepts.	**2**	**-**
	PART-A Design Thinking & Case Studies		
1.	**Foundations of UX Design** Core principles, usability heuristics, responsive & accessible design emphasis.	**2**	**24CSE464.1**
2.	**UX Trends in Messaging Platforms (WhatsApp/Slack/etc.)** Analyze interaction patterns, notification systems, and UX impact.	**2**	**24CSE464.1**
3.	**Design Sprint Activity** Empathize → define → ideate → prototype → test on a simple problem.	**2**	**24CSE464.2**
4.	**UPI Case Study** Explore minimalism, trust, branding, and interface consistency.	**2**	**24CSE464.2**
5.	**Build a Basic Design System (Figma)** Create components (buttons, grids, typography) for interface consistency.	**2**	**24CSE464.2**
6.	**Business Impact & UX Metrics** Measure usability through Net Promoter Score (NPS), Task Time, DAU, and ROI.	**2**	**24CSE464.2**
	PART-B		
7.	**Low-Fidelity Wireframe (Paper + Figma)** Sketch and digitize UI layouts for mobile/desktop.	**2**	**24CSE464.3**

8.	**Content Styling & Section Design** Populate prototype with realistic content and styling via Figma.	**2**	**24CSE464.3**
9.	**Basic Responsive Layout in HTML/CSS** Build a static webpage with semantic structure and responsive style.	**2**	**24CSE464.3,4**
10.	**Branding Layout in Figma** Add logos, headers, and visual branding to layouts..	**2**	**24CSE464.4**
11.	**Structured Component Design in Figma** Create reusable components for hero, services, footer sections.	**2**	**24CSE464.4**
12.	**Phase-by-Phase Design Report** Document the process and justify key design decisions.	**2**	**24CSE464.4**

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

Responsive Design Testing

- Analyze how web interfaces adapt across devices using browser dev tools.
- Tool: Chrome Developer Tools → "Toggle device toolbar"
- https://developer.chrome.com/docs/devtools/device-mode/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	Project Evaluation	Lab CIE Test
		10	**20**	**20**
L1	**Remember**	2	-	-
L2	**Understand**	2	-	-
L3	**Apply**	2	5	15
L4	**Analyze**	2	5	5
L5	**Evaluate**	2	5	5
L6	**Create**		5	-

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:

Text Books:

1. Designing and Prototyping Interfaces with Figma – *Fabio Staiano (2022)*
2. The Design of Everyday Things – *Don Norman (2013*)

Reference Books:

1. A Project Guide to UX Design – *Unger & Chandler*
2. The User Experience Team of One – *Leah Buley*

PROGRAMMING IN C++			
Course Code	**24CSE465**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24CSE465.1	Develop programs using classes and objects, incorporating appropriate access specifiers constructors and destructors
24CSE465.2	Develop programs using inline functions, friend functions, generic pointers, this pointer, and dynamic memory allocation.
24CSE465.3	Develop programs using inheritance, Virtual functions and polymorphism
24CSE465.4	Develop programs using file I/O operations, exception handling and generic templates

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE465.1	2	2	2	2	2	-	2	3	-	-	2	2	2
24CSE465.2	3	3	3	2	2	-	2	3	-	-	2	2	2
24CSE465.3	3	3	3	2	2	-	2	3	-	-	2	2	2
24CSE465.4	3	3	3	3	2	-	2	3	-	-	2	2	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Basic Knowledge of C programming fundamentals	**2**	**-**
	PART-A		
1.	Create a class student having four data members student id, student name, department and total marks with two member functions getdata and printdata.	**2**	**24CSE465.1**
2.	Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels. Write a C++ program to demonstrate Access Specifiers public, private and protected	**2**	**24CSE465.1**
3.	Write a C++ program to demonstrate default, parameterized and copy constructors, along with the destructor.	**2**	**24CSE465.1**
4.	Write a C++ program to find the largest of three numbers using inline function Write a C++ program to demonstrate friend function	**2**	**24CSE465.2**
5.	Write a C++ program to demonstrate the usage of Generic pointers Write a C++ program to demonstrate the usage of this pointer	**2**	**24CSE465.2**
6.	Write a C++ program to demonstrate dynamic memory allocation and deallocation using new and delete operators	**2**	**24CSE465.2**
	PART-B		

7.	Write a C++ program to demonstrate Single, Multiple, Multilevel and Hierarchical Inheritance.	**2**	**24CSE465.3**
8.	Write a C++ program to demonstrate virtual function and Pure virtual function	**2**	**24CSE465.3**
9.	Write a C++ program that demonstrates function overloading, operator overloading and overriding	**2**	**24CSE465.3**
10.	Write a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.	**2**	**24CSE465.4**
11.	Write a C++ program to demonstrate usage of try, catch and throw to handle exception	**2**	**24CSE465.4**
12.	Write a program to create a generic template for adding two integers and two float values and make use of the template to perform addition.	**2**	**24CSE465.4**

PART-C

Beyond Syllabus Virtual Lab Content

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

https://cse02-iiith.vlabs.ac.in/?utm_source=chatgpt.com

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Text Books:

1. Object Oriented Programming With C++, E. Balaguruswamy, 8th Edition, 2011, Tata McGraw Hill.
2. C++, The Complete Reference, Herbert Schildt, 8th Edition, 2017, McGraw Hill Education.

Reference Books:

1. C++ How To Program , Deital And Deital, 9th Edition, 2016, Pearson Education India.
2. Object Oriented Programming In Turbo C++, R. Lafore, 4th Edition, 2013, Galgotia, New Delhi

DESIGN THINKING AND FABRICATION			
Course Code	**24DTK47**	**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:

24DTK47.1	Identify innovation opportunities through real-world problem analysis and observation.
24DTK47.2	Propose a product or service idea using technical knowledge and feasibility insights.
24DTK47.3	Demonstrate empathy and creative thinking in the ideation and concept generation stages.
24DTK47.4	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**
24DTK47.1	3	-	-	-	-	-	-	-	-	-	-
24DTK47.2	3	3	2	-	-	-	-	-	-	-	-
24DTK47.3	3	3	2	-	-	-	-	-	-	-	-
24DTK47.4	3	3	2	1	2	-	-	-	-	-	2

MODULE-1	**INTRODUCTION TO DESIGN THINKING**	**24DTK47.1 24DTK47.3**	**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**	**24DTK47.3**	**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**	**24DTK47.1**	**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**	**24DTK47.3**	**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**	**24DTK47.2**	**3 Hours**

		24DTK47.4	

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

MINI PROJECT			
Course Code	**24CSE48**	**CIE Marks**	**50**
L: T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**0**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

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

24CSE48.1	Define and analyze project requirements, ensuring a clear understanding of the problem domain.
24CSE48.2	Apply programming skills to transform design into a functional software solution
24CSE48.3	Develop a system architecture and design that aligns with project goals
24CSE48.4	Develop and execute a rigorous testing strategy to identify and rectify bugs and issues
24CSE48.5	Create a comprehensive project plan, outlining tasks, timelines, and resource allocation
24CSE48.6	Produce comprehensive and well-structured documentation that effectively communicates software design, functionality, and usage instructions

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24CSE48.1	3	3	2	2	2	2	1	2	2	2	2	3	2
24CSE48.2	3	2	3	2	3	1	1	1	1	2	2	3	2
24CSE48.3	3	2	3	2	3	2	1	2	2	2	2	3	2
24CSE48.4	2	3	2	3	3	2	1	2	1	2	2	3	2
24CSE48.5	2	2	2	2	2	2	2	3	3	3	2	2	3
24CSE48.6	2	2	2	2	2	1	1	2	3	2	2	2	3

Mini Project Roadmap: Guiding Principles for Mini Project Success

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

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

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

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

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

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

Documentation:

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

Presentation:

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

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

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

Interdisciplinary Projects:

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

Prototype Development:

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

Simulation and Modelling:

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

Humanitarian and Social Impact Projects:

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

Advanced Coding and Software Development:

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

Environmental Sustainability Projects:

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

Crisis Response and Disaster Management:

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

Scientific Research Projects:

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

BASIC APPLIED MATHEMATICS-II
(Common to all Branches)

Course Code	**24DMAT41**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs. / Week	**2**	**Total Marks**	**50**
Credits	**00**	**Exam Hours**	**--**

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

24DMAT41.1	Gain knowledge of basic operations of vectors
24DMAT41.2	Use curl and divergence of a vector function in three dimensions
24DMAT41.3	Develop the ability to solve higher order Linear differential equations
24DMAT41.4	Know the basic concepts of Laplace transform to solve the Periodic functions and also solve initial and boundary value problems using Laplace transform method.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24DMAT41.1	3	3	-	-	-	-	-	-	-	-	-
24DMAT41.2	3	3	-	-	-	-	-	-	-	-	-
24DMAT41.3	3	3	-	-	-	-	-	-	-	-	-
24DMAT41.4	3	3	-	-	-	-	-	-	-	-	-

MODULE-1	**VECTORS**	24DMAT31.1	**8 Hours**

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

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

MODULE-2	**VECTOR DIFFERENTIATION**	24DMAT31.2	**8 Hours**

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

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

MODULE-3	**LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS**	24DMAT31.3	**8 Hours**

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

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

MODULE-4	**LAPLACE TRANSFORM**	24DMAT31.4	**8 Hours**

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

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

MODULE-5	**INVERSE LAPLACE TRANSFORM**	24DMAT31.4	**8 Hours**

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

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

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

RBT Levels		Marks Distribution		
		Theory Tests	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	-	-	-

Suggested Learning Resources:

Text Books:

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

Reference Books:

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

Web links and Video Lectures (e-Resources):

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

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

- Contents related activities (Activity-based discussions)
  - Problem solving Approach
  - Organizing Group wise discussions on related topics
  - Seminars

NATIONAL SERVICE SCHEME

Course Code	**24NSS30, 24NSS40, 24NSS50, 24NSS60**	**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:

24NSSX0.1	Understand the importance of his / her responsibilities towards society.
24NSSX0.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSSX0.3	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.
24NSSX0.4	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
24NSSX0.1	-	-	-	-	-	3	3	2	-	-	1
24NSSX0.2	-	-	-	-	-	3	3	2	-	-	1
24NSSX0.3	-	-	-	-	-	3	3	2	-	-	1
24NSSX0.4	-	-	-	-	-	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.	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS

	9. Spreading public awareness under rural outreach programs. (minimum 5 programs).		
6TH 24NSS60	**10.** Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). **11.** 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:

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/ 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
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/Govern ment Schemes officers	School 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
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/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
8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted 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/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
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/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

PHYSICAL EDUCATION AND SPORTS

Course Code	**24PED30, 24PED40, 24PED50, 24PED60**	**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:

24PEDX0.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PEDX0.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PEDX0.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PEDX0.4	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
24PEDX0.1	-	-	-	-	-	2	-	3	3	-	2
24PEDX0.2	-	-	-	-	-	2	-	3	3	-	2
24PEDX0.3	-	-	-	-	-	2	-	3	3	-	2
24PEDX0.4	-	-	-	-	-	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. B. Stress management. C. Aerobics. D. Traditional Games.	24PED30.3, 24PED30.4	10 HRS
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 2 Hrs/week

6TH 24PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. A. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 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	24PED60.1, 24PED60.2, 24PED60.3, 24PED60.4	Total 30 Hrs/ Semester 2 Hrs/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 Code	**24YOG30, 24YOG40, 24YOG50, 24YOG60**	**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:

24YOGX0.1	Understanding the origin, history, aim and objectives of Yoga
24YOGX0.2	Become familiar with an authentic foundation of Yogic practices
24YOGX0.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat
24YOGX0.4	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
24YOGX0.1	-	-	-	-	-	3	-	-	-	-	1
24YOGX0.2	-	-	-	-	-	3	-	-	-	-	1
24YOGX0.3	-	-	-	-	-	3	-	-	-	-	1
24YOGX0.4	-	-	-	-	-	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 b of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	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, Sarvanga **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:

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

Web links and Video Lectures (e-Resources):

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

Appendix A: List of Assessment Patterns

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

APPENDIX B: Outcome Based Education

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

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

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

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

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

Mapping of Outcomes

APPENDIX C: The Graduate Attributes of NBA

Engineering Knowledge: Apply 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

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

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)

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)

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)

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)

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

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

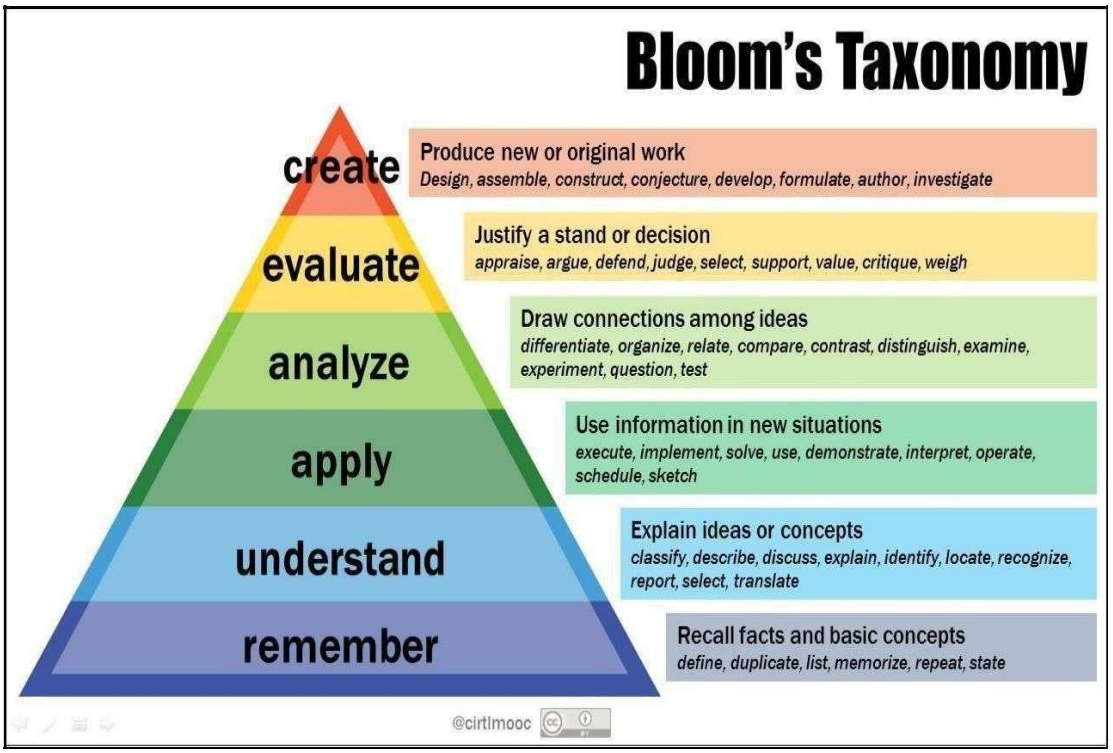
Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective language, and learning differences

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

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)

APPENDIX D: BLOOM'S TAXONOMY

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



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