

Analysis & Design of Algorithms		Semester	4
Course Code	BCS401	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
Course objectives: <ul style="list-style-type: none">• To learn the methods for analyzing algorithms and evaluating their performance.• To demonstrate the efficiency of algorithms using asymptotic notations.• To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.• To learn the concepts of P and NP complexity classes.			
Teaching-Learning Process (General Instructions) <p>These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none">1. Lecturer method (L) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.2. Utilize video/animation films to illustrate the functioning of various concepts.3. Promote collaborative learning (Group Learning) in the class.4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.6. Introduce topics through multiple representations.7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.8. Discuss the real-world applications of every concept to enhance students' comprehension.			
Module-1			
INTRODUCTION: What is an Algorithm?, Fundamentals of Algorithmic Problem Solving. FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. BRUTE FORCE APPROACHES: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching. Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)			
Module-2			
BRUTE FORCE APPROACHES (contd.): Exhaustive Search (Travelling Salesman problem and Knapsack Problem). DECREASE-AND-CONQUER: Insertion Sort, Topological Sorting. DIVIDE AND CONQUER: Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication.			

Chapter 3(Section 3.4), Chapter 4 (Sections 4.1,4.2), Chapter 5 (Section 5.1,5.2,5.3, 5.4)
Module-3
TRANSFORM-AND-CONQUER: Balanced Search Trees, Heaps and Heapsort. SPACE-TIME TRADEOFFS: Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. Chapter 6 (Sections 6.3,6.4), Chapter 7 (Sections 7.1,7.2)
Module-4
DYNAMIC PROGRAMMING: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. THE GREEDY METHOD: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. Chapter 8 (Sections 8.1,8.2,8.4), Chapter 9 (Sections 9.1,9.2,9.3,9.4)
Module-5
LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems. COPING WITH LIMITATIONS OF ALGORITHMIC POWER: Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem). Chapter 11 (Section 11.2, 11.3), Chapter 12 (Sections 12.1,12.2,12.3)
Course outcome (Course Skill Set) At the end of the course, the student will be able to: <ol style="list-style-type: none"> 1. Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity. 2. Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems. 3. Make use of transform & conquer and dynamic programming design approaches to solve the given real world or complex computational problems. 4. Apply greedy and input enhancement methods to solve graph & string based computational problems. 5. Analyse various classes (P,NP and NP Complete) of problems 6. Illustrate backtracking, branch & bound and approximation methods.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 220B2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally **reduced to 50 marks**

Suggested Learning Resources:**Textbooks**

1. Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3rd Edition (Indian), 2017, Pearson.

Reference books

1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Web links and Video Lectures (e-Resources):

- Design and Analysis of Algorithms: <https://nptel.ac.in/courses/106/101/106101060/>

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

- Promote real-world problem-solving and competitive problem solving through group discussions to engage students actively in the learning process.
- Encourage students to enhance their problem-solving skills by implementing algorithms and solutions through programming exercises, fostering practical application of theoretical concepts.

Assessment Methods -

1. Problem Solving Assignments (Hacker Rank/ Hacker Earth / Leadcode)
2. Gate Based Aptitude Test

COMPUTER GRAPHICS AND VISUALIZATION		Semester	4
Course Code	BCG402	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		
Course objectives: <ul style="list-style-type: none">• Understand concepts of Computer Graphics along with its applications• Exploring mathematics for 2D and 3D graphics along with OpenGL API's• Use of Computer graphics in animation and GUI design.• Demonstrate Geometric transformations, viewing on both 2D and 3D objects• Infer the representation of curves, surfaces, Color and Illumination models			
Teaching-Learning Process (General Instructions) <p>These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none">1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.			
MODULE-1			
Computer Graphics: Application of Computer Graphics. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL fill area functions, OpenGL Vertex arrays, Line drawing algorithm- Bresenham's. Textbook 2: Chapter -1[1.1] Textbook 1: Chapter -3[3.5], 4[4.1-4.5,4.8,4.9],5[5.1]			
MODULE-2			
2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, OpenGL raster transformations, Transformation between 2D coordinate systems, OpenGL geometric transformation functions. 3D Geometric Transformations: 3D Translation, rotation, scaling, OpenGL geometric transformations functions.			
MODULE-3			
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data , Logical Classification of Input Devices, Input Functions for Graphical Data, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface. Computer Animation: Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures. Textbook 1: Chapter -18[18.1-18.4,18.7,18.8],11[11.2-11.5,11.8-11.10]			
MODULE-4			

<p>Clipping: clipping window, normalization and viewport transformations, clipping algorithms, 2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping.</p> <p>Color Models: Properties of light, color models, RGB and CMY color models.</p> <p>Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model.</p> <p>Textbook 1: Chapter -7[7.2,7.3,7.5-7.7], 15[15.1,15.3],17[17.1,17.2,17.4,17.6]</p>
MODULE-5
<p>3D Viewing:3D viewing concepts, 3D viewing pipeline, Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, OpenGL 3D viewing functions.</p> <p>Visible Surface Detection Methods: Classification of visible surface Detection algorithms, depth buffer method.</p> <p>Textbook 1: Chapter -9[9.1,9.2,9.4-9.6,9.8,9.10],14[14.1,14.3]</p>

PRACTICAL COMPONENT OF IPCC*(May cover all / major modules)*

Sl.NO	Experiments
1	Develop OpenGL program to draw a line using Bresenham's algorithm for all types of slopes.
2	Develop OpenGL program to create and rotate a triangle about the origin and a fixed point.
3	Develop a OpenGL program to implement to recursively subdivide a tetrahedron to form 3D sierpinski gasket. The number of recursive steps is to be specified by the user.
4	Develop a OpenGL program to Spin 3D sierpinski gasket using OpenGL transformation matrices.
5	Develop a OpenGL program to Clip 2D lines using Cohen-Sutherland algorithm.
6	Develop a menu driven program to animate the polygon using 3D geometric transformations.
7	Develop a OpenGL program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing.
8	Develop a OpenGL program to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.
9	Develop a OpenGL program to draw a simple scene containing few 3D objects and provide day and night effect. Define suitably the position and properties of the light source used in the scene.

Course outcomes (Course Skill Set):

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

- Demonstrate simple algorithms using OpenGL Graphics primitives and attributes.
- Apply mathematical concepts for 2-D and 3-D geometric transformations.
- Make use of OpenGL functions for Interactive Input, GUI and animations.
- Explain clipping algorithms, color models and illumination models.
- Demonstrate visualization of surfaces and 3D objects.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two

Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version, 4th Edition, Pearson Education, 2011.
2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2009.

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106/106/106106090/>
2. <https://nptel.ac.in/courses/106/102/106102063/>
3. <https://nptel.ac.in/courses/106/103/106103224/>
4. <https://nptel.ac.in/courses/106/102/106102065/>
5. <http://www.opengl-redbook.com/>
6. www.opengl.org

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

Simulation/implementation of Real world applications(user interfaces/animations ... etc.) using OpenGL libraries in VS code editor/Code blocks and C/Java/python as host language.

DATABASE MANAGEMENT SYSTEM		Semester	4
Course Code	BCS403	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	
Examination nature (SEE)	Theory		
Course objectives: <ul style="list-style-type: none">● To Provide a strong foundation in database concepts, technology, and practice.● To Practice SQL programming through a variety of database problems.● To Understand the relational database design principles.● To Demonstrate the use of concurrency and transactions in database.● To Design and build database applications for real world problems.● To become familiar with database storage structures and access techniques.			
Teaching-Learning Process <p>These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none">1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.2. Use of Video/Animation to explain functioning of various concepts.3. Encourage collaborative (Group Learning) Learning in the class.4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.6. Introduce Topics in manifold representations.7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding9. Use any of these methods: Chalk and board, Active Learning, Case Studies			
MODULE-1			No. of Hours: 8
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.			
Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.			
Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams,Specialization and Generalization.			
Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3			
MODULE-2			No. of Hours: 8

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.
Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.
Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5

RBT: L1, L2, L3

MODULE-3

No. of Hours:8

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

SQL: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL

Textbook 1: Ch 14.1 to 14.7, Ch 6.1 to 6.5

RBT: L1, L2, L3

MODULE-4

No. of Hours:8

SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL.

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Textbook 1: Ch 7.1 to 7.3, Ch 20.1 to 20.6

RBT: L1, L2, L3

MODULE-5

No. of Hours:08

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j

Textbook 1:Chapter 21.1 to 21.5, Chapter 24.1 to 24.6

RBT: L1, L2, L3

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	<p>Create a table called Employee & execute the following.</p> <p>Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION)</p> <ol style="list-style-type: none"> 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO,ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result. 3. Add primary key constraint and not null constraint to the employee table. 4. Insert null values to the employee table and verify the result.
2	<p>Create a table called Employee that contain attributes EMPNO,ENAME,JOB, MGR,SAL & execute the following.</p> <ol style="list-style-type: none"> 1. Add a column commission with domain to the Employee table. 2. Insert any five records into the table. 3. Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Empno is 105.
3	<p>Queries using aggregate functions(COUNT,AVG,MIN,MAX,SUM),Group by,Orderby.</p> <p>Employee(E_id, E_name, Age, Salary)</p> <ol style="list-style-type: none"> 1. Create Employee table containing all Records E_id, E_name, Age, Salary. 2. Count number of employee names from employeetable 3. Find the Maximum age from employee table. 4. Find the Minimum age from employeetable. 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.
4	<p>Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary.</p> <p>CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)</p>
5	<p>Create cursor for Employee table & extract the values from the table. Declare the variables ,Open the cursor & extrct the values from the cursor. Close the cursor.</p> <p>Employee(E_id, E_name, Age, Salary)</p>
6	<p>Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.</p>
7	<p>Install an Open Source NoSQL Data base MangoDB & perform basic CRUD(Create, Read, Update & Delete) operations. Execute MangoDB basic Queries using CRUD operations.</p>
<p>Course outcomes (Course Skill Set): At the end of the course, the student will be able to:</p> <ul style="list-style-type: none"> ● Describe the basic elements of a relational database management system ● Design entity relationship for the given scenario. ● Apply various Structured Query Language (SQL) statements for database manipulation. ● Analyse various normalization forms for the given application. ● Develop database applications for the given real world problem. ● Understand the concepts related to NoSQL databases. 	
<p>Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The</p>	

minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Text Books:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

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

Mini Project:

- Project Based Learning

Analysis & Design of Algorithms Lab		Semester	4
Course Code	BCSL404	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	2
Examination type (SEE)	Practical		
Course objectives: <ul style="list-style-type: none">• To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.• To apply diverse design strategies for effective problem-solving.• To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks.			
Sl.No	Experiments		
1	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.		
2	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.		
3	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.		
4	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.		
5	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.		
6	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.		
7	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.		
8	Design and implement C/C++ Program to find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d .		
9	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.		
10	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.		
11	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n . The elements can be read from a file or can be generated using the random number generator.		
12	Design and implement C/C++ Program for N Queen's problem using Backtracking.		

Course outcomes (Course Skill Set):

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

1. Develop programs to solve computational problems using suitable algorithm design strategy.
2. Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).
3. Make use of suitable integrated development tools to develop programs
4. Choose appropriate algorithm design techniques to develop solution to the computational and complex problems.
5. Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.

- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
 - The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
 - All laboratory experiments are to be included for practical examination.
 - (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
 - Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
 - Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
 - General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
 - Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- Virtual Labs (CSE): <http://cse01-iiith.vlabs.ac.in/>

DISCRETE MATHEMATICAL STRUCTURES		Semester	IV
Course Code	BCS405A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
Course objectives: <ol style="list-style-type: none">1. To help students to understand discrete and continuous mathematical structures.2. To impart basics of relations and functions.3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.4. To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.			
Teaching-Learning Process Pedagogy (General Instructions): These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.2. State the need for Mathematics with Engineering Studies and Provide real-life examples.3. Support and guide the students for self-study.4. You will assign homework, grading assignments and quizzes, and documenting students' progress.5. Encourage the students to group learning to improve their creative and analytical skills.6. Show short related video lectures in the following ways:<ul style="list-style-type: none">● As an introduction to new topics (pre-lecture activity).● As a revision of topics (post-lecture activity).● As additional examples (post-lecture activity).● As an additional material of challenging topics (pre-and post-lecture activity).● As a model solution for some exercises (post-lecture activity).			
Module-1: Fundamentals of Logic			
Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems. <div>(8 hours)</div>			
(RBT Levels: L1, L2 and L3)			
Module-2: Properties of the Integers			
Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition. <div>(8 Hours)</div>			
(RBT Levels: L1, L2 and L3)			
Module-3: Relations and Functions			

<p>Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.</p> <p>Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. (8 hours)</p> <p>(RBT Levels: L1, L2 and L3)</p>
<p align="center">Module-4: The Principle of Inclusion and Exclusion</p> <p>The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.</p> <p>Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients. (8 Hours)</p> <p>(RBT Levels: L1, L2 and L3)</p>
<p align="center">Module-5: Introduction to Groups Theory</p> <p>Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem. (8 Hours)</p> <p>(RBT Levels: L1, L2 and L3)</p>
<p>Course outcome (Course Skill Set)</p> <p>At the end of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements. 2. Demonstrate the application of discrete structures in different fields of computer science. 3. Apply the basic concepts of relations, functions and partially ordered sets for computer representations. 4. Solve problems involving recurrence relations and generating functions. 5. Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p>

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. **Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction", 5th Edition, Pearson Education, 2004.**
2. **Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education. 2004.**

Reference Books:

1. **Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept-based approach", Universities Press, 2016**
2. **Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6th Edition, McGraw Hill, 2007.**
3. **Jayant Ganguly: "A Treatise on Discrete Mathematical Structures", Sanguine-Pearson, 2010.**
4. **D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications, Latest Edition, Thomson, 2004.**
5. **Thomas Koshy: "Discrete Mathematics with Applications", Elsevier, 2005, Reprint 2008.**

Web links and Video Lectures (e-Resources):

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- <http://www.themathpage.com/>
- <http://www.abstractmath.org/>
- <http://www.ocw.mit.edu/courses/mathematics/>

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

- Quizzes
- Assignments
- Seminar

GRAPH THEORY		Semester	IV
Course Code	BCS405B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
Course objectives: <ul style="list-style-type: none">Understand the basic concepts of graphs and their properties, and operations of graphs.Hamiltonian and Euler graphs, trees and matrix representation of the graph.Apply the concepts of a planar graph, matching and colouring in computer science engineering.			
Teaching-Learning Process Pedagogy (General Instructions): <p>These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none">In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.State the need for Mathematics with Engineering Studies and Provide real-life examples.Support and guide the students for self-study.You will assign homework, grading assignments and quizzes, and documenting students' progress.Encourage the students to group learning to improve their creative and analytical skills.Show short related video lectures in the following ways:<ul style="list-style-type: none">As an introduction to new topics (pre-lecture activity).As a revision of topics (post-lecture activity).As additional examples (post-lecture activity).As an additional material of challenging topics (pre-and post-lecture activity).As a model solution for some exercises (post-lecture activity).			
Module-1			
Introduction to Graphs: Introduction- Basic definition – Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. Paths and circuits – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components. (8 hours) (RBT Levels: L1, L2 and L3)			
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation		
Module-2			
Eulerian and Hamiltonian graphs: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. Directed graphs – types of digraphs, Digraphs and binary relation. (8 hours) (RBT Levels: L1, L2 and L3)			
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation		
Module-3			

Trees – properties, pendant vertex, Distance and centres in a tree - Rooted and binary trees, counting trees, spanning trees. Connectivity Graphs: Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits. (8 hours) (RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-4	
Planar Graphs: Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual. Graph Representations: Matrix representation of graphs-Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix. (8 hours) (RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-5:	
Graph Colouring: Colouring- Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem and Five colour problem. Greedy colouring algorithm. (8 hours) (RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Course outcome (Course Skill Set) At the end of the course, the student will be able to: <ol style="list-style-type: none"> 1. Explain the fundamental concepts of properties and representation of graphs. 2. Solve the problems involving characterization and operations on graphs. 3. Apply concepts of trees and graph connectivity to solve real world problems. 4. Apply the concepts of planar graph and graph representations to solve the given problem. 5. Use the concepts of matching and coloring of graphs to solve the real world problems. 	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016
2. J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1st edition, 2008.

Reference Books:

1. Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
2. Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.
3. R. Diestel, Graph Theory, free online edition, 2016: diestel-graph-theory.com/basic.html.
4. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001
5. Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd., 2010

Web links and Video Lectures (e-Resources):

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program
- VTU EDUSAT Program.

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

- Quizzes
- Assignments
- Seminar

OPTIMIZATION TECHNIQUE		Semester	IV
Course Code	BCS405C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
Course objectives: The objectives of the course are to facilitate the learners to: <ul style="list-style-type: none">• Appreciate the importance of linear algebra in computer science and allied engineering science.• Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.• Improve their mathematical thinking and acquire skills required for sustained lifelong learning.			
Teaching-Learning Process Pedagogy (General Instructions): These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students’ theoretical and applied Mathematical skills.2. State the need for Mathematics with Engineering Studies and Provide real-life examples.3. Support and guide the students for self–study.4. You will assign homework, grading assignments and quizzes, and documenting students' progress.5. Encourage the students to group learning to improve their creative and analytical skills.6. Show short related video lectures in the following ways:<ul style="list-style-type: none">• As an introduction to new topics (pre-lecture activity).• As a revision of topics (post-lecture activity).• As additional examples (post-lecture activity).• As an additional material of challenging topics (pre-and post-lecture activity).• As a model solution of some exercises (post-lecture activity).			
Module-1: VECTOR CALCULUS			
Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series. (8 hours) (RBT Levels: L1, L2 and L3)			
Module-2: APPLICATIONS OF VECTOR CALCULUS			
Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error. (8 hours) (RBT Levels: L1, L2 and L3)			
Module-3: Convex Optimization-1			
Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3-point search and Fibonacci search. (8 hours) (RBT Levels: L1, L2 and L3)			
Module-4: Convex Optimization-2			

<p>Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent. (8 hours) (RBT Levels: L1, L2 and L3)</p>
<p align="center">Module-5: Advanced Optimization</p>
<p>Momentum-based gradient descent methods: Adagrad, RMSprop and Adam. Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods. (8 hours) (RBT Levels: L1, L2 and L3)</p>
<p>Course outcome (Course Skill Set) At the end of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Apply the concepts of vector calculus to solve the given problem. 2. Apply the concepts of partial differentiation in machine learning and deep neural networks. 3. Analyze the convex optimization algorithms and their importance in computer science & engineering. 4. Apply the optimization algorithms to solve the problem. 5. Analyze the advanced optimization algorithms for machine learning .
<p>Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p>
<p>Continuous Internal Evaluation:</p> <ul style="list-style-type: none"> • There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component. • Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks • Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks) • The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.
3. S. Boyd, N. Parikh, and E. Chu, "Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.
3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc.

Web links and Video Lectures (e-Resources):

- <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
- <https://www.math.ucdavis.edu/~linear/linear.pdf>
- <https://www.coursera.org/learn/linear-algebra-machine-learning>
- <https://nptel.ac.in/syllabus/111106051/>
- https://github.com/epfml/OptML_course
- <https://www.youtube.com/playlist?list=PL4O4bXkI-fAeYrsBqTUYn2xMjJAqlFQzX>

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

- Quizzes
- Assignments
- Seminar

LINEAR ALGEBRA		Semester	IV
Course Code	BCS405D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		
Course objectives: <ul style="list-style-type: none">• To equip the students with standard concepts and tools in Linear algebra which will find them useful in their disciplines.• Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.• Improve their mathematical thinking and acquire skills required for sustained lifelong learning.			
Teaching-Learning Process Pedagogy (General Instructions): These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.2. State the need for Mathematics with Engineering Studies and Provide real-life examples.3. Support and guide the students for self-study.4. You will assign homework, grading assignments and quizzes, and documenting students' progress.5. Encourage the students to group learning to improve their creative and analytical skills.6. Show short related video lectures in the following ways:<ul style="list-style-type: none">• As an introduction to new topics (pre-lecture activity).• As a revision of topics (post-lecture activity).• As additional examples (post-lecture activity).• As an additional material of challenging topics (pre-and post-lecture activity).• As a model solution of some exercises (post-lecture activity).			
Module-1: VECTOR SPACES			
Introduction, Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates. (8 hours) (RBT Levels: L1, L2 and L3)			
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation		
Module-2: LINEAR TRANSFORMATIONS			
Introduction, Linear Mappings, Geometric linear transformation of i_2 , Kernel and Image of a linear transformations, Rank-Nullity Theorem (No proof), Matrix representation of linear transformations, Singular and Non-singular linear transformations, Invertible linear transformations (8 hours) (RBT Levels: L1, L2 and L3)			
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation		
Module-3: EIGENVALUES AND EIGENVECTORS			

Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form. (RBT Levels: L1, L2 and L3) (8 hours)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-4: INNER PRODUCT SPACES	
Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error. (RBT Levels: L1, L2 and L3) (8 hours)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Module-5: OPTIMIZATION TECHNIQUES IN LINEAR ALGEBRA	
Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction – Principal component analysis. (RBT Levels: L1, L2 and L3) (8 hours)	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
Course outcome (Course Skill Set) At the end of the course, the student will be able to: <ol style="list-style-type: none"> 1. Explain the concepts of vector spaces, subspaces, bases, dimension and their properties. 2. Use matrices and linear transformations to solve the given problem. 3. Compute Eigenvalues and Eigenvectors for the linear transformations 4. Determine orthogonality of inner product spaces. 5. Apply the optimization techniques to solve the problems. 	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	
Continuous Internal Evaluation: <ul style="list-style-type: none"> • There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks	

- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. **David C. Lay, Steven R. Lay, Judi J Mc. Donald: "Linear Algebra and its applications"**, Pearson Education, 6th Edition, 2021.
2. **Gilbert Strang: "Linear Algebra and its applications"**, Brooks Cole, 4th edition, 2005.

Reference Books:

1. **Richard Bronson & Gabriel B. Costa: "Linear Algebra: An Introduction"**, 2nd edition. Academic Press, 2014.
2. **Seymour Lipschutz, Marc Lipso: "Theory and problems of linear algebra"**, Schaum's outline series - 6th edition, 2017, McGraw-Hill Education.
3. **Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong: "Mathematics for Machine learning"**, Cambridge University Press, 2020.

Web links and Video Lectures (e-Resources):

- <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
- <https://www.math.ucdavis.edu/~linear/linear.pdf>
- <https://www.coursera.org/learn/linear-algebra-machine-learning>
- <https://nptel.ac.in/syllabus/111106051/>
- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program
- VTU EDUSAT Program.

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

- Quizzes
- Assignments
- Seminar

JavaScript and jQuery: Interactive Front-End Web Development		Semester	4
Course Code	BCGL456A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	02
Examination type (SEE)	Practical		
Course objectives: <ul style="list-style-type: none">• To learn primitives of JavaScript Programming• To make use of arrays and objects in JavaScript• To learn jQuery primitive methods to access HTML elements• To demonstrate jQuery methods to manipulate HTML elements and handling events			
Sl.NO	Experiments		
1	a. Develop a JavaScript program to Capitalize the first letter of each Word of a sentence (String). b. Develop a JavaScript program to Check a string starts with 'Java'.		
2	a. Develop a JavaScript program to display the current day and time. b. Develop a JavaScript program to reverse a given string		
3	a. Develop a JavaScript program to display a message using alert. b. Develop a JavaScript program to display a confirm message on a button click. c. Develop a JavaScript program to read value through prompt window and display the value on a button click.		
4	a. Develop a JavaScript program to display (on respective button clicks) multiplication and division of two numbers. Read values from the textboxes and design two buttons (use DOM). b. Develop a JavaScript program to highlight with red color the HTML links (<a>) having class name “high” (use DOM).		
5	a. Develop a JavaScript program to read the content of HTML paragraph and update (on button click event) with the suitable Text read from the HTML Textbox (Use innerHTML) b. Develop a JavaScript program to check for an attribute (‘href’ in <a>) and get its value/display on the Web page on a button click.		
6	a. Develop a JavaScript program to sort a list of numbers (Use arrays and functions) b. Develop a JavaScript program to create a hotel object using object literal syntax having properties (name, location, room rate, discount etc), constructors and method (offer-price). Create few objects to demonstrate the access of properties and an associated method.		
7	a. Develop a jQuery program to disable/enable the form and disable right click menu. b. Develop a jQuery program to Underline all the words and firs word bold.		
8	a. Develop a jQuery program to Add options to a drop-down list. b. Develop a jQuery program to Change the button text.		
9	a. Develop a jQuery program to Disable a link. b. Develop a jQuery program to Delete all table rows except first one.		
10	a. Develop a jQuery program to Change a CSS class. b. Develop a jQuery program to Set the background color.		
11	a. Develop a jQuery program to Add two classes. b. Develop a jQuery program to Add a specified class.		
12	a. Develop a jQuery program to read and display the value entered in a Textbox and option chosen in dropdown list with relevant events. b. Develop a jQuery program to Animate paragraph element.		
NOTE: Necessary HTML elements (and CSS) are to be designed for the experiments.			

Course outcomes (Course Skill Set):

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

- Apply basic concepts of JavaScript to develop simple programs
- Design programs to handle structured data (object) and data items (array)
- Develop programs to access and manipulate HTML with DOM and event handling
- Illustrate the role of jQuery selectors to access HTML elements of Web pages
- Apply jQuery methods to manipulate HTML and trigger events in Web pages

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the

schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK:** JAVASCRIPT & JQUERY: Interactive Front-End Web Development, By JON DUCKETT, WILEY 2014.
- JavaScript Tutorial (<https://www.w3schools.com/js/>)
- jQuery Tutorial (<https://www.w3schools.com/jquery/>)
- LEARN JAVASCRIPT (<https://www.javascript.com/learn>)

Responsive Web design with Bootstrap 5.0		Semester	4
Course Code	BCGL456B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	02
Examination type (SEE)	Practical		
Course objectives: <ul style="list-style-type: none">• To learn basic classes of CSS framework: Bootstrap 5.0• To develop simple Webpages with Bootstrap 5.0 classes• To make use of Bootstrap 5.0 classes for Web based User Interfaces			
Sl.NO	Experiments		
1	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Headings. [Refer Book: Chapter 13.1-13.5]		
2	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Text and Fonts. [Refer Book: Chapter 13.6-13.11]		
3	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Lists, Colors and Bootstrap Buttons. [Refer Book: Chapter 13.13-13.14 and 13.18-13.19]		
4	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Borders, Margins and Paddings. [Refer Book: Chapter 13.15-13.17]		
5	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Containers. [Refer Book: Chapter 14.1-14.3]		
6	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Grid System. [Refer Book: Chapter 14.4-14.7]		
7	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Images, Cards and Gutters. [Refer Book: Chapter 14.8-14.10]		
8	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Nav and Footers. [Refer Book: Chapter 14.11-14.12]		
9	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Badges, Progress bar, spinners and Pagination. [Refer Bootstrap 5 Tutorial @ www.w3schools.com]		
10	Develop a Web page(s) with suitable HTML elements to demonstrate Bootstrap 5.0 framework classes for Modals, Alerts and Popover. [Refer Bootstrap 5 Tutorial @ www.w3schools.com]		
11	Develop your personal online CV or a professional CV using suitable Bootstrap classes.		
12	Develop a blog post about your favourite topic or create memoirs/additional stories using suitable Bootstrap classes.		

Course outcomes (Course Skill Set):

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

- Apply concepts of Bootstrap framework based layout and navigation classes to develop Web Pages
- Design Web pages to organize data and present text with features using Bootstrap framework
- Develop Web User interfaces for varieties of interactions with Bootstrap framework classes
- Build Web pages involving animations, popups and accordions with Bootstrap framework classes
- Make use of Bootstrap framework image, alert and modal classes in developing Web pages

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the

schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK:** Bootstrap 5 Foundations, By Daniel Foreman, Foreman Technology LTD; 2nd edition (24 April 2021)
- Bootstrap 5 Tutorial (<https://www.w3schools.com/bootstrap5/>)
- Bootstrap 5 (<https://www.geeksforgeeks.org/bootstrap-5-introduction/>)

Mobile First Web design with W3.CSS		Semester	4
Course Code	BCGL456C	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	02
Examination type (SEE)	Practical		
Course objectives: <ul style="list-style-type: none">• To learn basic classes of CSS framework: W3.CSS• To develop simple Webpages with W3.CSS classes• To make use of JavaScript and W3.CSS classes for Web based User Interfaces			
Sl.NO	Experiments		
1	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes for layouts: CSS Layouts (CSS layout, CSS responsive, CSS grid and CSS display). [Refer Book: Chapter 2]		
2	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes for color and features: CSS colors and CSS Helper classes (Tabs and Sidebar). [Refer Book: Chapter 3, 4]		
3	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes for enhancement: Helper classes (Accordions, cards, panels). [Refer Book: Chapter 4]		
4	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS containers. [Refer Book: Chapter 5]		
5	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS visual elements. [Refer Book: Chapter 6]		
6	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS Text. [Refer Book: Chapter 7]		
7	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS Menus. [Refer Book: Chapter 8]		
8	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS Tables and Lists. [Refer Book: Chapter 9]		
9	Develop a Web page(s) with suitable HTML elements to demonstrate the following W3.CSS framework classes: CSS Buttons, Labels and Form Elements. [Refer Book: Chapter 10, 11]		
10	Develop a Web page(s) with suitable HTML elements and JavaScript to demonstrate the following W3.CSS framework classes: Animations, Modals and Images. [Refer Book: Chapter 12, 13, 14]		
11	Develop your personal online CV or a professional CV using suitable W3.CSS classes.		
12	Develop a blog post about your favourite topic or create memoirs/additional stories using suitable W3.CSS classes.		

Course outcomes (Course Skill Set):

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

- Apply concepts of W3.CSS based layout and selection classes to develop Web Pages
- Design Web pages to organize data and present text with features using W3.CSS
- Develop Web User interfaces for varieties of interactions with W3.CSS classes
- Build Web pages involving animations and accordions with W3.CSS classes
- Make use of W3.CSS image and modal classes in developing Web pages

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
 - SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
 - The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
 - All laboratory experiments are to be included for practical examination.
 - (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
 - Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
 - Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
 - General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
 - Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.
- The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK:** W3.CSS Succinctly, By Joseph D. Booth, Syncfusion, 2018 (Free e-book download at: https://www.syncfusion.com/ebooks/w3_css_succinctly OR <https://www.syncfusion.com/succinctly-free-ebooks/confirmation/w3-css-succinctly>)
- W3.CSS Tutorial (<https://www.w3schools.com/w3css/>)
- W3.CSS (https://www.tutorialspoint.com/w3css/w3css_tutorial.pdf)

Technical Writing using LaTeX		Semester	4																											
Course Code	BCSL456D	CIE Marks	50																											
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50																											
Credits	01	Exam Hours	02																											
Examination type (SEE)	Practical																													
Course objectives: <ul style="list-style-type: none">• To introduce the basic syntax and semantics of the LaTeX scripting language• To understand the presentation of tables and figures in the document• To illustrate the LaTeX syntax to represent the theorems and mathematical equations• To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document																														
Sl.NO	Experiments																													
1	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.																													
2	Develop a LaTeX script to create a document that displays the sample Abstract/Summary																													
3	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting]																													
4	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry]																													
5	Develop a LaTeX script to create a document that contains the following table with proper labels. <table><tr><th rowspan="2">S.No</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr><tr><th>Subject1</th><th>Subject2</th><th>Subject3</th></tr><tr><td>1</td><td>4XX22XX001</td><td>Name 1</td><td>89</td><td>60</td><td>90</td></tr><tr><td>2</td><td>4XX22XX002</td><td>Name 2</td><td>78</td><td>45</td><td>98</td></tr><tr><td>3</td><td>4XX22XX003</td><td>Name 3</td><td>67</td><td>55</td><td>59</td></tr></table>			S.No	USN	Student Name	Marks			Subject1	Subject2	Subject3	1	4XX22XX001	Name 1	89	60	90	2	4XX22XX002	Name 2	78	45	98	3	4XX22XX003	Name 3	67	55	59
S.No	USN	Student Name	Marks																											
			Subject1	Subject2	Subject3																									
1	4XX22XX001	Name 1	89	60	90																									
2	4XX22XX002	Name 2	78	45	98																									
3	4XX22XX003	Name 3	67	55	59																									
6	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept																													
7	Develop a LaTeX script to create a document that consists of the following two mathematical equations <div>$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$= \frac{-2 \pm \sqrt{2^2 - 4*(1)*(-8)}}{2*1}$$= \frac{-2 \pm \sqrt{4+32}}{2}$</div> <div>$\varphi_{\sigma}^{\lambda} A_t = \sum_{\pi \in C_t} \text{sgn}(\pi) \varphi_{\sigma}^{\lambda} \varphi_{\pi}^{\lambda}$$= \sum_{\tau \in C_{\sigma t}} \text{sgn}(\sigma^{-1} \tau \sigma) \varphi_{\sigma}^{\lambda} \varphi_{\sigma^{-1} \tau \sigma}^{\lambda}$$= A_{\sigma t} \varphi_{\sigma}^{\lambda}$</div>																													

8	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document
9	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section
10	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
11	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2e library
12	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: <ul style="list-style-type: none"> ● Apply basic LaTeX command to develop simple document ● Develop LaTeX script to present the tables and figures in the document ● Illustrate LaTeX script to present theorems and mathematical equations in the document ● Develop programs to generate the complete report with citations and a bibliography ● Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the document 	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners

jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK:** A Short Introduction to LaTeX BY FIRUZA KARMALI (AIBARA), A book for beginners, 2019
- **BOOK:** Formatting Information: A Beginner's Introduction to Typesetting with LaTeX, BY PETER FLYNN, Comprehensive TeX Archive Network (2005)
- LaTeX TUTORIAL: [<https://latex-tutorial.com/tutorials/>]
- LaTeX TUTORIAL: [<https://www.javatpoint.com/latex>]