

MACHINE LEARNING		Semester	6
Course Code	BCM601	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	3
Examination nature (SEE)	Theory/Practical		
<p>Course objectives:</p> <ul style="list-style-type: none"> To understand the basic theory underlying machine learning, types, and the process. To become familiar with data and visualize univariate, bivariate, and multivariate data using statistical techniques and dimensionality reduction. To understand various machine learning algorithms such as similarity-based learning, regression, decision trees, and clustering. To familiarize with learning theories, probability-based models, and reinforcement learning, developing the skills required for decision-making in dynamic environments. 			
<p>Teaching-Learning Process (General Instructions)</p> <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"> Lecturer method (L) needs not to be only traditional lecture method, can make use of digital tools to visually demonstrate key ideas that could be adopted to attain the outcomes. Use think-pair-share strategies where students collaborate in pairs or groups to discuss concepts and solve small problems before sharing their understanding with the class. Use case studies that apply machine learning in fields like finance, healthcare, and marketing to reinforce practical applications. 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. Utilize tools like TensorFlow Playground, Google Colab, and Jupyter Notebooks to visually demonstrate the impact of different machine learning models and hyperparameters on datasets. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions. 			
MODULE-1		8 Hours	
<p>Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Application.</p> <p>Understanding Data: Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data.</p> <p>Textbook 1: Chapter - 1 (1.1-1.7), 2 (2.1-2.6)</p>			
MODULE-2		8 Hours	
<p>Understanding Data: Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques.</p> <p>Basics of Learning Theory: Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning.</p> <p>Textbook 1: Chapter -2 (2.7-2.10), 3 (3.1 - 3.6)</p>			
MODULE-3		8 Hours	
<p>Similarity-based Learning: Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).</p> <p>Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression.</p>			

Textbook 1: Chapter – 4 (4.1 – 4.5), 5 (5.1 – 5.7)
MODULE-4 8 Hours
<p>Models Based on Decision Trees: Introduction to Decision Tree, Decision Tree for Classification, Impurity Measures for Decision Tree Construction, Properties of Decision Tree Classifier (DTC), Applications in Breast Cancer Data, Regression Based on Decision Trees.</p> <p>Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.</p>
Textbook 2: Chapter – 3 (3.1 – 3.6), Textbook 1: Chapter –8 (8.1 – 8.3)
MODULE-5 8 Hours
<p>Clustering: Introduction to Clustering, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering.</p> <p>Reinforcement Learning: Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.</p>
Textbook 2: Chapter – 7 (7.1 – 7.5), Textbook 1: Chapter - 14 (14.1, 14.2, 14.4, 14.9)

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset. Textbook 1: Chapter 2
2	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California Housing dataset. Textbook 1: Chapter 2
3	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2. Textbook 1: Chapter 2
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples. Textbook 1: Chapter 3.
5	Develop a program to implement k-Nearest Neighbour algorithm to classify the randomly generated 100 values of x in the range of $[0,1]$. Perform the following based on dataset generated. <ul style="list-style-type: none"> a. Label the first 50 points $\{x_1, \dots, x_{50}\}$ as follows: if $(x_i \leq 0.5)$, then $x_i \in \text{Class}_1$, else $x_i \in \text{Class}_2$ b. Classify the remaining points, x_{51}, \dots, x_{100} using KNN. Perform this for $k=1,2,3,4,5,20,30$ Textbook 2: Chapter – 2
6	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs Textbook 1: Chapter – 4
7	Develop a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression. Textbook 1: Chapter – 5
8	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample. Textbook 2: Chapter – 3

9	Develop a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets. Textbook 2: Chapter – 4
10	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result. Textbook 2: Chapter – 4
<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"> ● Demonstrate the need for machine learning, its relationship to other fields, and different types of machine learning ● Illustrate the fundamental principles of multivariate data and apply dimensionality reduction techniques. ● Apply similarity-based learning methods and perform linear, polynomial regression analysis ● Apply decision trees for classification and regression problems, and Bayesian models for probabilistic learning ● Analyze the clustering algorithms and reinforce their understanding by applying Q-learning for decision-making tasks 	
<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 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.</p>	
<p>CIE for the theory component of the IPCC (maximum marks 50)</p> <ul style="list-style-type: none"> ● 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. 	
<p>CIE for the practical component of the IPCC</p> <ul style="list-style-type: none"> ● 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. 	
<p>SEE for IPCC</p>	

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:

Textbooks

1. S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford University Press, 2021.
2. M N Murty and Ananthanarayana V S, "Machine Learning: Theory and Practice", Universities Press (India) Pvt. Limited, 2024.

Reference Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
2. Miroslav Kubat, "An Introduction to Machine Learning", Springer, 2017.

Web links and Video Lectures (e-Resources):

- https://www.drssidhar.com/?page_id=1053
- <https://www.universitiespress.com/resources?id=9789393330697>
- https://onlinecourses.nptel.ac.in/noc23_cs18/preview
- <https://www.geeksforgeeks.org/machine-learning/>
- https://www.w3schools.com/python/python_ml_getting_started.asp
- https://www.tutorialspoint.com/machine_learning/index.htm

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

- Course project by taking suitable machine learning-based real-world application problem **[10 Marks]**

DESIGN PROCESSES AND PERSPECTIVES		Semester	6
Course Code	BCG602	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03
Examination type (SEE)	Theory		
<p>Course Objectives:</p> <p>[1] Gain a strong foundation in design processes and methodologies.</p> <p>[2] Master the principles of user-centered design to create effective solutions.</p> <p>[3] Foster creative thinking and enhance prototyping skills for innovative design.</p> <p>[4] Utilize advanced design tools and technologies to develop functional products.</p> <p>[5] Incorporate ethical, cultural, and sustainability considerations into the design process.</p>			
<p>Teaching-Learning Process</p> <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' understanding 9. Use any of these methods: Chalk and board, Active Learning, Case Studies 			
Module 1: Foundations of Design Processes			10
Hours			
<p>Introduction - Design basics, Engineering design process ,Importance of the Engineering Design Process Types of Designs, A Simplified Iteration Model, Design Method Versus Scientific Method , A Problem-Solving Methodology , Considerations of a good design , Societal considerations in engineering design, Problem definition and need identification.</p> <p>Text book 1 Chapter 1: 1.1, 1.2.1, 1.2.2, 1.3.1, 1.3.2, 1.3.3, 1.5, 1.9 Chapter 5: 5.1, 5.2</p>			
Module 2: User-Centered Design Principles			10
Hours			

<p>Gathering information, data, information, and knowledge, Information literacy and the internet, Finding sources of design information, Library sources. Embodiment design, Product architecture, Steps in developing product architecture.</p> <p>Text book 1 Chapter 4: 4.1.1, 4.1.2, 4.2, 4.3 Chapter 8: 8.1, 8.2, 8.3</p>	
<p>Module 3: Creative Thinking and Prototyping</p>	10
<p>Hours</p> <p>Introduction to creative thinking, Creativity and problem solving, Supports to creative thinking, Barriers to creative thinking, Creative thinking methods, Brainstorming, Quick idea generation tools, Methods for design generation. Generating design concepts, Systematic methods for designing, Decision making and concept selection, Behavioral aspects of decision making, Evaluation processes, Design selection based on judgment and experience.</p> <p>Text book 1 Chapter 6: 6.1, 6.2.1, 6.2.2, 6.3.1, 6.3.2, 6.4.1, 6.4.2 Chapter 7: 7.7.1, 7.2, 7.3.1</p>	
<p>Module 4: Design Tools and Technologies</p>	10
<p>Hours</p> <p>Visual Design Basics: The Golden Rules, Place the User in Control, Reduce the User's Memory Load, Make the Interface Consistent, User Interface Design Steps, Interface Design Steps, Applying Interface Design Steps, User Interface Design Patterns, WebApp Interface Design, WebApp Interface Design, Interface Design Principles and Guidelines, Interface Design Workflow for WebApps, Computer Science Design Basics, Design Patterns, Kinds of Patterns, Frameworks, Pattern-Based Software Design, Pattern-Based Software Design, Pattern-Based Design in Context, Thinking in Patterns, User Interface Design Patterns, WebApp Design Patterns.</p> <p>Textbook 2 Cychapter 11: 11.1.1, 11.1.2, 11.1.3, 11.4.1, 11.4.2, 11.5.1, 11.5.2 Chapter 12: 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.5. 12.6</p>	
<p>Module 5: Ethical, Cultural, and Sustainable Design</p>	10 Hours
<p>The environmental movement, Ecosystems and balance, Dependence on fossil fuels, Behavior changes started by the u.s. environmental movement, Sustainability, Wced report on sustainability, Challenges of sustainability for business, End-of-life product transformations.</p> <p>Text book 1 Chapter 15: 15.1.1, 15.1.4, 15.1.5, 15.2, 15.3, 15.4</p>	
<p>COURSE OUTCOME:</p> <p>[1] Demonstrate a comprehensive understanding of design processes and their applications in engineering. [2] Apply user-centered design principles to develop effective and innovative solutions. [3] Apply creative thinking and problem-solving skills through prototyping and design generation methods. [4] Make use of design tools and technologies to create functional and user-friendly interfaces. [5] Integrate ethical, cultural, and sustainability considerations into design solutions.</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 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 22OB2.4, 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 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

Books**Text Books :**

1. *"Engineering Design: A Systematic Approach (6th Edition)"* by Gerhard Pahl and Wolfgang Beitz. 6th edition
2. *"Software Engineering: A Practitioner's Approach"* by Roger S. Pressman. 7th Edition

Reference Books

1. "The Design of Everyday Things" by Don Norman, 2nd Edition (2013).
2. "Design Thinking: Process and Methods" by Robert Curedale, 3rd Edition (2013).

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

Note: Consider ANY FIVE from the list [5 x 5 = 25 Marks]

Create a design flowchart for an engineering problem:

Example: Design a flowchart for an automated coffee machine process from the user pressing the button to serving the coffee.

Conduct a brainstorming session to generate multiple design ideas:

Example: Brainstorm different design ideas for a mobile app aimed at promoting healthy eating habits.

Prototype a simple user interface using a design tool:

Example: Create a wireframe for an online shopping app's homepage using Figma or Adobe XD.

Analyze and present a case study on a user-centered design project:

Example: Analyze the user-centered design approach taken by Apple in designing the iPhone interface and present the findings.

Design a product architecture for a real-world scenario:

Example: Design the architecture for a wearable fitness tracker, including sensors, data processing, and communication with mobile devices.

Conduct a group discussion on sustainability in design and create a sustainable product concept:

Example: Discuss the environmental impact of plastic packaging and come up with an alternative sustainable design for packaging a food product.

Multimedia Systems Design		Semester	6
Course Code	BCG613A	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		
<p>Course objectives:</p> <ul style="list-style-type: none"> ● Learn characteristics of Multimedia contents ● Understand and compare different text and image standards. ● Understand audio digitization, processing, and storage. ● Gain knowledge of multimedia architecture. 			
<p>Teaching-Learning Process (General Instructions) 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) needs not to be only traditional lecture method, can make use of digital tools to visually demonstrate key ideas that could be adopted to attain the outcomes. 2. Use think-pair-share strategies where students collaborate in pairs or groups to discuss concepts and solve small problems before sharing their understanding with the class. 3. Use case studies that apply machine learning in fields like finance, healthcare, and marketing to reinforce practical applications. 4. 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. 5. Utilize tools to visually demonstrate the impact of different concepts and methods of animation. 6. Demonstrate ways to solve the same problem and encourage the students to develop their own creative solutions. 			
Module-1			
Introduction, Multimedia Presentation and Production, Characteristics of a Multimedia Presentation, Uses of Multimedia, Analog and Digital Representations, Digitization, Nyquist's Sampling Theorem, Quantization Error Textbook: Chapter 1 - 1.1-1.3, 1.5-1.9			
Module-2			
Text - Introduction, Types of Text, Unicode Standard, Font, Text Compression, Text File Formats. Image - Introduction, Image Data Representation, Image Processing, Image File Formats, Image Processing Software. Textbook: Chapter 2 - 2.2-2.4, 2.6-2.7 & Chapter 3 - 3.2 ,3.4, 3.10-3.11			
Module-3			
Introduction, Acoustics, Sound Waves, Types and Properties of Sounds, Psycho-Acoustics, Digital Audio, Synthesizers, Musical Instrument Digital Interface (MIDI), Digital Audio Processing, Speech, Audio File Formats, Audio Processing Software. Textbook: chapter 5 - 5.2 - 5.5, 5.7-5.10 (5.10.1 - 5.10.10), 5.11, 5.14, 5.17			
Module-4			
Introduction, Motion Video, Analog Video Signal Representation, Television Systems, Video Color Spaces , Digital Video, Digital Video Processing, Video File Formats, Video Editing Concepts, Video Processing Software. Textbook: Chapter 6 - 6.2, 6.4-6.6, 6.7(6.7.1, 6.7.4,6.7.5), 6.8(6.8.1), 6.10, 6.11,6.12			

Module-5	
	<p>Introduction, User Interfaces, OS Multimedia Support, Multimedia Extensions, Distributed Multimedia Applications, Real-time Protocols, Synchronization.</p> <p>Textbook: Chapter 10 – 10.2-10.4, 10.6, 10.7, 10.9</p>
Course outcome (Course Skill Set)	
<p>At the end of the course, the student will be able to :</p> <ol style="list-style-type: none"> 1. Explain the fundamentals of digitization and multimedia presentation. 2. Compare different text and image standards. 3. Illustrate the need of audio digitization, processing, and storage. 4. Demonstrate video digitization, processing, and storage. 5. Compare the protocols and multimedia support provided by processors, OS and programming platforms. 	
Assessment Details (both CIE and SEE)	
<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 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.</p>	
Continuous Internal Evaluation:	
<ul style="list-style-type: none"> ● 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:	
<p>Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).</p> <ol style="list-style-type: none"> 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:	
Textbook:	
<ol style="list-style-type: none"> 1. Ranjan Parekh, Principles of Multimedia – 2nd edition, McGraw Hill publication, 2017. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Prabhat K Andleigh and Kiran Thakrar, Multimedia systems Design, Pearson, 2023. 	

2. Fed Halsall, Multimedia Communications: Applications, networks, protocols and Standards, Pearson, 2024.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/117105083>
- <https://www.scribd.com/document/379501045/106105035>

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

- Course project (using GNU/ MATLAB or other tools) to implement the concepts and applications such as audio/video playing or streaming applications, image editing/processing, and displaying applications by using multimedia concepts. [25 marks]

Cloud Computing & Security		Semester	VI
Course Code	BIS613D	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	3
Examination type (SEE)	Theory		
<p>Course objectives:</p> <ul style="list-style-type: none"> ● Introduce the rationale behind the cloud computing revolution and the business drivers ● Understand various models, types and challenges of cloud computing ● Understand the design of cloud native applications, the necessary tools and the design tradeoffs. ● Realize the importance of Cloud Virtualization, Abstraction's, Enabling Technologies and cloud security 			
<p>Teaching-Learning Process (General Instructions) 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. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding. 6. Use any of these methods: Chalk and board, Active Learning, Case Studies. 			
Module-1			
<p>Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency. Textbook 1: Chapter 1: 1.1 to 1.5</p>			
Module-2			
<p>Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation. Textbook 1: Chapter 3: 3.1 to 3.5</p>			
Module-3			
<p>Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of</p>			

<p>Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.</p> <p>Textbook 1: Chapter 4: 4.1 to 4.5</p>
<p>Module-4</p>
<p>Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security.</p> <p>Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.</p> <p>Textbook 2: Chapter 11: 11.1 to 11.3, 11.5 to 11.8, 11.10 to 11.14</p> <p>Textbook 1: Chapter 4: 4.6</p>
<p>Module-5</p>
<p>Cloud Programming and Software Environments:</p> <p>Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.</p> <p>Textbook 1: Chapter 6: 6.1 to 6.5</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. Describe various cloud computing platforms and service providers. 2. Illustrate the significance of various types of virtualization. 3. Identify the architecture, delivery models and industrial platforms for cloud computing based applications. 4. Analyze the role of security aspects in cloud computing. 5. Demonstrate cloud applications in various fields using suitable cloud platforms.

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 22OB2.4, 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 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:

Text Books:

1. Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, Elsevier 2012
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, 2nd Edition, Elsevier 2018

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, Mastering Cloud Computing McGrawHill Education, 1st Edition, 2017
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017.
3. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication, 1st Edition, 2009
4. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.

Web links and Video Lectures (e-Resources):

- <https://freevideolectures.com/course/4639/nptel-cloud-computing/1>.
- <https://www.youtube.com/playlist?list=PLShJjCRzJWxhz7SfG4hpaBD5bKOloWx9J>
- https://www.youtube.com/watch?v=EN4fEbcFZ_E
- <https://www.youtube.com/watch?v=RWgW-CgdIk0>
- <https://www.geeksforgeeks.org/virtualization-cloud-computing-types/>
- <https://www.javatpoint.com/cloud-service-provider-companies>

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

- Installation of virtualization software (Virtual box, Xen etc..) and run applications with different OS. - 10 Marks
- Implement cloud applications using GAE, AWS, Azure/simulate cloud applications using Cloudsim/ Greencloud/ Cloud Analyst etc... - 15 Marks

Blockchain Technology		Semester	6
Course Code	BCS613A	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		
<p>Course objectives:</p> <ul style="list-style-type: none"> • To Understand Blockchain terminologies with its applications. design • To learn working principles of Blockchain and methodologies used in Bitcoin • To gain knowledge on Ethereum Network, Wallets, Nodes, Smart contract & DApps • To learn blockchain Based Application Architecture using Hyperledger and the Smart Contract Lifecycle 			
<p>Teaching-Learning Process (General Instructions) 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/Demonstration 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. Use animations/videos to help the students to understand the concepts. 			
Module-1			
<p>Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.</p> <p>Chapter 1</p>			
Module-2			
<p>Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization.</p> <p>Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, Second pre-image resistance, Collision resistance, Message Digest (MD), Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA).</p> <p>Chapter 2, Chapter 3: pg:56-105</p>			
Module-3			

<p>Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block , The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a blockchain, The DAO.</p> <p>Chapter 4:pg:111-148, Chapter 6</p>
Module-4
<p>Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum blockchain , Ethereum virtual machine (EVM), Accounts, Block, Ether, Messages, Mining, The Ethereum network. Hands-on: Clients and wallets –Geth.</p> <p>Chapter 7: pg: 210-227, 235-269</p>
Module-5
<p>Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda.</p> <p>Chapter 9</p>
<p>Course outcomes (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. Explain the Blockchain terminologies with its applications. design 2. Illustrate the working principles of Blockchain and the Smart Contract Lifecycle 3. Demonstrate the principles and methodologies used in Bitcoin 4. Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps. 5. Make use of Hyperledger in Blockchain Based Application Architecture.

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 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:**Books**

1. Imran Bashir. "Mastring Blockchain", Third Edition, Packt – 2020.

Reference Book

1. Andreas M. , Mastering Bitcoin: Programming the Open Blockchain – O'rielly – 2017.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106104220>
- <https://www.geeksforgeeks.org/blockchain/>
- <https://www.tutorialspoint.com/blockchain/index.htm>

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

- Course Project: Covers the implementation of the major concepts outlined in the syllabus– 25 Marks

ADVANCED JAVA		Semester	6
Course Code	BCS613D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Note- Students who have not opted for Java course in earlier semester, student has to undergo a bridge course on basics of java before the commencement of 6th SEM.

Course objectives:

- CLO 1. Understanding the fundamentals of collection framework
- CLO 2. Demonstrate the fundamental concepts of String operations and Swing applications
- CLO 3. Design and develop web applications using Java servlets and JSP
- CLO 4. Apply database interaction through Java database Connectivity

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

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. Promote collaborative learning (Group Learning) in the class.
3. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
4. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyse information rather than merely recalling it.
5. Introduce Topics in manifold representations.
6. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.
7. Discuss application of every concept to solve the real world problems.

MODULE-1

The collections and Framework: Collections Overview, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Arrays, The legacy Classes and Interfaces, Parting Thoughts on Collections.

Text Book 1: Ch. 20

MODULE-2

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String, joining strings, Additional String Methods, StringBuffer , StringBuilder

Text Book 1: Ch 18

MODULE-3

Introducing Swing: The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Painting in Swing.

Exploring Swing : JLabel and ImageIcon, JTextField, The Swing Buttons-JButton, JToggleButton, Check Boxes, Radio Buttons

Text Book 1: Ch 32 and Ch. 33

MODULE-4

Introducing servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Jakarta. Servlet Package; Reading Servlet Parameter; The Jakarta.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects.

Text Book 1: Ch 36

Text Book 2: Ch 11

MODULE-5

JDBC Objects: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

Text Book 2: Ch 06

Course outcomes (Course Skill Set):

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

CO 1. Apply appropriate collection class/interface to solve the given problem

CO 2. Demonstrate the concepts of String operations in Java

CO 3. Apply the concepts of Swings to build Java applications

CO 4. Develop web based applications using Java servlets and JSP

CO 5. Use JDBC to build database applications

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 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:

Textbooks

1. Herbert Schildt: JAVA the Complete Reference. Twelfth Edition, Tata McGraw-Hill.
2. Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill 2007

Reference Books

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2004.
3. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. <https://nptel.ac.in/courses/106/105/106105225/>
3. <https://youtu.be/qGMxs-PbFPk>

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

Programming assignments on Strings, Collections and Swings (15 marks)

Programming assignments on Servlets and JDBC (10 marks)

INTRODUCTION TO DATA STRUCTURES		Semester	6
Course Code	BCS654A	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		
<p>Course Objectives:</p> <ul style="list-style-type: none"> ● Introduce primitive and non-primitive data structures ● Understand the various types of data structure along their operations ● Study various searching and sorting algorithms ● Assess appropriate data structures during program development / problem solving 			
<p>Teaching-Learning Process (General Instructions)</p> <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. 9. Use any of these methods: Chalk and board, Active Learning, Case Studies. 			
Module-1			
<p>Arrays: Introduction, One-Dimensional Arrays, Two-Dimensional Arrays, Initializing Two-Dimensional Arrays, Multidimensional arrays.</p> <p>Pointers: Introduction, Pointer Concepts, Accessing Variables through Pointers, Pointer Applications, Dynamic Memory Allocation Functions.</p> <p>Structures and Unions: Introduction, Declaring Structures, Giving Values to Members, Structure Initialization, Comparison of Structure Variables, Arrays of Structures, Arrays within Structures, Nested Structures, Unions, Size of Structures.</p> <p>Textbook 1: Ch. 8.1 to 8.5, Ch. 12.1 to 12.8, 12.10, 12.11.</p> <p>Textbook 2: Ch. 2.1 to 2.3, 2.5, 2.9.</p>			
Module-2			

<p>Stacks: Introduction, Stack Operations, Stack Implementation using Arrays, Applications of Stacks.</p> <p>Queues: Introduction, Queue Operations, Queue Implementation using Arrays, Different Types of Queues: Circular Queues, Double-Ended Queues, Priority Queues, Applications of Queues.</p> <p>Textbook 2: Ch. 6.1 to 6.3, Ch. 8.1 to 8.2.</p>
Module-3
<p>Linked Lists: Introduction, Singly Linked List, Self-Referential Structures, Operations on Singly Linked Lists: Insert-Delete-Display, Implementation of Stacks and Queues using Linked List, Concatenate two Lists, Reverse a List without Creating a New Node, Static Allocation Vs Linked Allocation.</p> <p>Circular Singly Linked List: Introduction, Operations: Insert-Delete-Display.</p> <p>Textbook 2: Ch. 9.1 to 9.2, 9.3 (Only 9.3.1 to 9.3.5, 9.3.11 to 9.3.12), 9.4 to 9.5.</p>
Module-4
<p>Trees: Introduction, Basic Concepts, Representation of Binary Trees, Operations on Binary Trees: Insertion-Traversals-Searching-Copying a Tree, Binary Search Trees, Operations on Binary Search Trees: Insertion-Searching-Find Maximum and Minimum Value-Count Nodes, Expression Trees.</p> <p>Textbook 2: Ch. 10.1 to 10.4, 10.5 (Only 10.5.1, 10.5.2, 10.5.3.1, 10.5.3.2, 10.5.3.4), 10.6.3.</p>
Module-5
<p>Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort.</p> <p>Searching: Introduction, Linear Search, Binary Search.</p> <p>Textbook 1: Ch. 17.1, 17.2.6, 17.3.2.</p> <p>Textbook 2: Ch. 11.1 to 11.3, 11.10.1.</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. Develop C programs utilizing fundamental concepts such as arrays, pointers and structures. 2. Apply data structures like stacks and queues to solve problems. 3. Develop C programs using linked lists and their various types. 4. Explain the fundamental concepts of trees and their practical applications. 5. Demonstrate different sorting and searching algorithms and determine their algorithmic complexities.

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 22OB2.4, 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 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:

Text Books:

1. E Balagurusamy, "C Programming and Data Structures", 4th Edition, McGraw-Hill, 2007.
2. A M Padma Reddy, "Systematic Approach to Data Structures using C", 9th Revised Edition, Sri Nandi Publications, 2009.

Reference Books:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, 2014.
2. Seymour Lipschutz, "Data Structures Schaum's Outlines", Revised 1st Edition, McGraw-Hill, 2014.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=DFpWCl_49i0
- https://www.youtube.com/watch?v=x7t_-ULoAZM
- <https://www.youtube.com/watch?v=I37kGX-nZEI>
- <https://www.youtube.com/watch?v=XuCbpw6Bj1U>
- <https://www.youtube.com/watch?v=R9PTBwOzceo>

- <https://www.youtube.com/watch?v=qH6yxkw0u78>
- <https://archive.nptel.ac.in/courses/106/105/106105085/>
- https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

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

Develop C programs that focus on Data Structure concepts such as arrays, pointers, structures, stacks, queues, linked lists, trees as well as, sorting and searching algorithms (25 Marks).

FUNDAMENTALS OF OPERATING SYSTEMS		Semester	6
Course Code	BCS654B	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		
<p>Course objectives:</p> <ul style="list-style-type: none"> ● To demonstrate the need and different types of OS ● To discuss suitable techniques for management of different resources ● To analyse different memory, storage, and file system management strategies. 			
<p>Teaching-Learning Process (General Instructions) 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. 9. Use any of these methods: Chalk and board, Active Learning, Case Studies. 			
Module-1			
<p>Introduction: What operating systems do; Computer System organization; Computer System Organization, Computer System architecture; Operating System operations; Resource Management</p> <p>Operating System Structures: Operating System Services, User and Operating System interface; System calls, Application Program Interface, Types of system calls;</p> <p>Textbook 1: Chapter 1: 1.1, 1.2, 1.3,1.4, 1.5 Chapter 2: 2.1, 2.2 (2.2.1, 2.2.2), 2.3 (2.3.2, 2.3.3)</p>			
Module-2			
<p>Process Management: Process concept; Process scheduling; Operations on processes; Interprocess Communication</p> <p>Multi-threaded Programming: Overview; Multithreading models, Thread Libraries</p> <p>Textbook 1: Chapter 3: 3.1-3.4, Chapter 4: 4.1, 4.3 5, 4.4</p>			
Module-3			

<p>CPU Scheduling: Basic Concepts, Scheduling criteria, Scheduling algorithms, Thread Scheduling,</p> <p>Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization;</p> <p>Textbook 1: Chapter 5: 5.1, 5.2,5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.4 Chapter 6: 6.1, 6.2.,6.3, 6.6</p>
Module-4
<p>Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.</p> <p>Memory Management: Background; Contiguous memory allocation; Paging; Structure of page table</p> <p>Textbook 1: Chapter 8: 8.1-8.8 Textbook 1: Chapter 9: 9.1-9.4 (9.4.1, 9.4.2)</p>
Module-5
<p>Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement;</p> <p>File System Interface: File concept; Access methods; Directory Structure, Protection, File System Implementation: File System Structure, File System Operations,</p> <p>File System Internals: File Systems, File System Mounting; Partition and Mounting, File sharing;</p> <p>Textbook 1: Chapter 10: 10.1-10.3, 10.4 (10.4.1, 10.4.2, 10.4.4.) Chapter 13: 13.1, 13.2, 13.3 (13.3.1, 13.3.2, 13.3.3), 13.4 (13.4.1, 13.4.2) Chapter 15: 15.1-15.4</p>
<p>Course outcomes (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. Explain the fundamentals of operating systems. 2. Apply appropriate CPU scheduling algorithm for the given scenarios. 3. Analyse the various techniques for process synchronization and deadlock handling. 4. Apply the various techniques for memory management 5. Analyse the importance of File System Mounting and File Sharing

Assessment Details (both CIE and SEE)

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- 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 teacher should not conduct two assignments at the end of the semester if two assignments are planned.
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Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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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:

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 10th edition, Wiley-India, 2015

Reference Books

2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition, 2010
3. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013, P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008

Reference Books:

1. Akshay Kulkarni, Adarsha Shivananda, "Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Apress, 2019.
2. T V Geetha, "Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", Pearson, 2024.

3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer Academic Publishers.

Web links and Video Lectures (e-Resources):

- 1.<https://archive.nptel.ac.in/courses/106/105/106105214/>
- 2.<https://archive.nptel.ac.in/courses/106/102/106102132/>

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

- Students are expected to prepare animated PPT to illustrate the different types of Process Scheduling and Paging. **(10 Marks)**
- Students are required to prepare detailed case study report on Deadlocks **OR** Students can illustrate deadlock using any programming language **(15 Marks)**

MOBILE APPLICATION DEVELOPMENT		Semester	6
Course Code	BIS654C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		
<p>Course objectives:</p> <ul style="list-style-type: none"> Create, test and debug Android application by setting up Android development environment. Implement adaptive, responsive user interfaces that work across a wide range of devices. Infer long running tasks and background work in Android applications Demonstrate methods in storing, sharing and retrieving data in Android applications Analyze performance of android applications Describe the steps involved in publishing Android application to share with the world. 			
<p>Teaching-Learning Process (General Instructions) 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. Chalk and board, power point presentations 2. Online material (Tutorials) and video lectures. 3. Demonstration of setup Android application development environment & programing examples. 4. Illustrate user interfaces for interacting with apps and triggering actions 			
Module-1			
<p>Introduction to Android OS: Android Description – Open Handset Alliance – Android. Ecosystem – Android versions – Android Activity – Features of Android – Android Architecture Stack Linux Kernel. Configuration of Android Environment: Operating System – Java JDK Android SDK – Android Development Tools (ADT) – Android Virtual Devices (AVDs) – Emulators Dalvik Virtual Machine – Differences between JVM and DVM – Steps to Install and Configure Eclipse and SDK.</p> <p>(Chapters 1 & 2)</p>			
Module-2			
<p>Create the first android application: Directory Structure. Android User Interface: Understanding the Components of a screen– Linear Layout – Absolute Layout – Frame. Layout Relative Layout – Table Layout.</p> <p>(Chapters 3 & 4)</p>			
Module-3			

<p>Designing User Interface with View – Text View – Button – Image Button – Edit Text Check Box – Toggle Button – Radio Button and Radio Group – Progress Bar – Auto complete Text View – Spinner – List View – Grid View – Image View - Scroll View – Custom Toast – Alert – Time and Date Picker.</p> <p>(Chapter 5)</p>
<p>Module-4</p>
<p>Activity: Introduction – Intent – Intent filter – Activity life cycle – Broadcast life cycle Service. Multimedia: Android System Architecture – Play Audio and Video – Text to Speech.</p> <p>(Chapters 6 & 7)</p>
<p>Module-5</p>
<p>SQLite Database in Android: SQLite Database – Creation and Connection of the database – Transactions. Case Study: SMS Telephony and Location Based Services.</p> <p>(Chapters 8, 9, & 10)</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. Explain Mobile Application Ecosystem like concepts, architecture, and lifecycle of mobile applications on Android 2. Identify the key components of mobile application frameworks and development tools. 3. Apply design principles to create intuitive and responsive user interfaces using appropriate UI/UX tools. 4. Develop Functional Mobile Applications -Integrate core functionalities such as layouts, event handling, navigation, and multimedia support into applications. 5. Implement local data storage mechanisms (SQLite, Shared Preferences) and external databases (Firebase, APIs) for mobile applications.

<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 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.</p> <p>Continuous internal Examination (CIE)</p> <ul style="list-style-type: none"> ● 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 22OB2.4, 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. <p>Internal Assessment Test question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examinations (SEE) SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.</p> <p style="text-align: center;">OR</p> <p>MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then</p> <ol style="list-style-type: none"> 1. The question paper will have ten questions. Each question is set for 10 marks. 2. There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7). 3. The students have to answer 5 full questions, selecting one full question from each module.
<p>Suggested Learning Resources:</p> <p>Books</p> <ol style="list-style-type: none"> 1. TEXT BOOK 1. Prasanna Kumar Dixit, "Android", Vikas Publishing House Private Ltd., Noida, 2014. 2. REFERENCE BOOKS <ol style="list-style-type: none"> 1. Reto Meier and Wrox Wiley, “Professional Android 4 Application Development”, 2012. 2. ZiguradMednieks, LaridDornin, G.BlakeMeike, Masumi Nakamura, “Programming Andriod”, O’Reilly,2013. 3. Robert Green, Mario Zechner, “Beginning Android 4 Games Development”, Apress Media LLC, New York, 2011
<p>Web links and Video Lectures (e-Resources):</p>

	<ul style="list-style-type: none">• https://www.geeksforgeeks.org/android-tutorial/• https://developer.android.com/• https://www.tutorialspoint.com/android• https://www.w3schools.blog/android-tutorial
	<p>Activity Based Learning (Suggested Activities in Class)/Practical-Based Learning:</p> <ol style="list-style-type: none">1. Programming exercises, fostering the practical application of theoretical concepts. [25 marks]

INTRODUCTION TO ARTIFICIAL INTELLIGENCE		Semester	6
Course Code	BAI654D	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 understand the primitives of AI ● To familiarize Knowledge Representation Issues ● To understand fundamentals of Statistical Reasoning, Natural Language Processing. 			
Teaching-Learning Process (General Instructions)			
These are sample strategies; which teachers can use to accelerate the attainment of the various course outcomes.			
<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. 9. Use any of these methods: Chalk and board, Active Learning, Case Studies 			
Module-1			
What is artificial intelligence? Problems, Problem Spaces, and search Text Book 1: Ch 1, 2			
Module-2			
Knowledge Representation Issues, Using Predicate Logic, representing knowledge using Rules. Text Book 1: Ch 4, 5 and 6.			
Module-3			
Symbolic Reasoning under Uncertainty, Statistical reasoning Text Book 1: Ch 7, 8			
Module-4			
Game Playing, Natural Language Processing Text Book 1: Ch 12 and 15			
Module-5			
Learning, Expert Systems. Text Book 1: Ch 17 and 20			

Course outcomes (Course Skill Set)

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

1. Identify the problems where the adaptation of AI has significant impact.
2. Analyse the different approaches of Knowledge Representation.
3. Explain Symbolic Reasoning under Uncertainty and Statistical reasoning.
4. Derive the importance of different types of Learning Techniques.
5. Explain Natural Language Processing and Expert System.

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 22OB2.4, 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 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:**Text Books:**

1. E. Rich, K. Knight & S. B. Nair, Artificial Intelligence, 3rd Edition, McGraw Hill.,2009

Reference Books

2. Stuart Russell, Peter Norving, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education

3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, Prentice Hall of India, 2015
4. G. Luger, Artificial Intelligence: Structures and Strategies for complex problem Solving, 4th Edition, Pearson Education, 2002.
5. N.P. Padhy “Artificial Intelligence and Intelligent Systems”, Oxford University Press, 2015

Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/106102220>
2. <https://nptel.ac.in/courses/106105077>
3. <https://archive.nptel.ac.in/courses/106/105/106105158/>
4. <https://archive.nptel.ac.in/courses/106/106/106106140/>

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

- Apply NLP steps for any given real time scenario. Students are expected to document different NLP steps and their output for the given scenario. Students can use python or any programming language of their choice. **(10 Marks)**
- Students are expected to identify different case studies/scenarios where expert systems can be adopted. Students need to prepare a report on any one case study. **(15 marks)**

UI/UX Lab		Semester	6
Course Code	BCGL606	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 explore and understand the nuances of User Experience and User Interface ● To gain mastery over the usage of Figma for designing and prototyping UI/UX ● To understand user requirement and translate it into UI/UX prototype ● To analyse apps and websites and understand how they can be continually improved ● To understand the UI components and interactions being used in different apps and websites 			
Sl.NO	Experiments (Designing and Prototyping using Figma)		
NOTE: Wire frames can be hand-drawn and recorded by the students. Designing and Prototyping can be done using Figma.			
1	Chat App Redesign: Create a Wireframe and redesign any popular chat app.		
2	Food App: Create a wireframe, Design and Prototype the UI Pages for the food application.		
3	Social Media App: Create a wireframe, Design and Prototype social media photo sharing app.		
4	Product Website: Design and prototype a product website page. Create web pages and rollovers for the web pages		
5	Travel Agency Website: Create a wireframe, Design and prototype the UI for the website including design for Home Page with search bar, Activities page, Client Testimonial Page, Image Gallery		
6	UI/UX Designer Portfolio Design: Create a wireframe, Design and prototype a UI for a portfolio including design for About page, Work showcase page, Blog page, contact page		
7	Dashboard Design: Create a wireframe, Design and Prototype Dashboard UI page, add some Dashboard details, statistics and graphs, Add dropdown options for some dashboard details		
8	E-Commerce Website: Create a wireframe, Design and prototype Web pages including product category pages (example: mobiles, gaming consoles, Speakers), product pages in each category, buy now page, add to cart page		
9	Educational Website: Create a wireframe, Design and Prototype the UI for an educational website – Include a Homepage with footer, About Us Page, Programs page, Instructors page, Pricing page, Payments page with radial buttons. Design dropdowns for programs button		
10	Music Player App: Create a wireframe, Design and prototype the pages with a background and a Rollover button, and Song selection Page with a Home Rollover button. The third page may include animated play and pause button, play music animation, timer animation.		
Course outcomes (Course Skill Set):			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> ● Apply the basics of wireframing in designing apps and Websites. ● Make use of Figma for designing and prototyping UI/UX for different types of apps and Websites. ● Analyse user requirements and translate the requirements to design prototypes. ● Demonstrate the UI/UX concepts applied when designing the prototype of apps and Websites. ● Develop (redesign) the existing apps & Websites with customized design. 			

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:

- <https://www.figma.com/>
- UX Programming for Beginners, August, 2022
- <https://www.udemy.com/course/learn-figma-web-design>
- <https://www.udemy.com/course/figma-2023-master-class-realtime-uiux-web-projects>

Mobile Application Development with Flutter		Semester	6
Course Code	BCGL657A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	Practical		
Course objectives:			
<ul style="list-style-type: none"> ● To introduce basics of Flutter platform for progressive app development ● To gain knowledge on user interface support in Flutter. ● To learn various programming elements required for app development. ● To develop progressive applications with flutter. 			
Sl.NO	Experiments		
1	Develop an application using Flutter to print “Hello world and Hello Flutter”.		
2	Develop an application using Flutter to Increment and Decrement Numbers (Counter App).		
3	Develop Login Screen Application.		
4	Develop a “To-do List” Application.		
5	Develop Calculator Application.		
6	Develop an application to Check the Weather in Countries Across the world (Weather app).		
7	Develop a “Stopwatch” application using Flutter.		
8	Develop an application that Navigate from one Screen to another (Seamless navigation).		
9	Develop Basic E-commerce UI Application.		
10	Develop an application to implement Animates Logo.		
11	Develop an application that tracks our daily Expenses and get a report chart.		
12	Develop an application to Play Quiz and get the Score Board.		
Course outcomes (Course Skill Set):			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> ● Demonstrate basics elements Flutter platform for progressive app development. ● Develop user interface designs for applications. ● Experiment with different programming elements of app development. ● Develop progressive applications for 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 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:

- <https://flutter.dev/>
- <https://developers.google.com/learn/pathways/intro-to-flutter>
- <https://github.com/flutter/flutter>
- <https://www.geeksforgeeks.org/flutter-tutorial/>
- <https://www.tutorialspoint.com/flutter/index.htm>

Generative AI		Semester	6
Course Code	BAIL657C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:1:0	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	Practical		
Course objectives: <ul style="list-style-type: none"> • Understand the principles and concepts behind generative AI models • Explain the knowledge gained to implement generative models using Prompt design frameworks. • Apply various Generative AI applications for increasing productivity. • Develop Large Language Model-based Apps. 			
SI.NO	Experiments		
1.	Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyze results.		
2.	Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships. Generate contextually rich outputs using embeddings. Write a program to generate 5 semantically similar words for a given input.		
3.	Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics.		
4.	Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.		
5.	Use word embeddings to create meaningful sentences for creative tasks. Retrieve similar words for a seed word. Create a sentence or story using these words as a starting point. Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words.		
6.	Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.		
7.	Summarize long texts using a pre-trained summarization model using Hugging face model. Load the summarization pipeline. Take a passage as input and obtain the summarized text.		
8.	Install langchain, cohere (for key), langchain-community. Get the api key(By logging into Cohere and obtaining the cohere key). Load a text document from your google drive . Create a prompt template to display the output in a particular manner.		
9.	Take the Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: The founder of the Institution. When it was founded. The current branches in the institution . How many employees are working in it. A brief 4-line summary of the institution.		
10	Build a chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.		

Course outcomes (Course Skill Set):

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

- Develop the ability to explore and analyze word embeddings, perform vector arithmetic to investigate word relationships, visualize embeddings using dimensionality reduction techniques
- Apply prompt engineering skills to real-world scenarios, such as information retrieval, text generation.
- Utilize pre-trained Hugging Face models for real-world applications, including sentiment analysis and text summarization.
- Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.

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:

Books:

1. Modern Generative AI with ChatGPT and OpenAI Models: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4, by Valentina Alto, Packt Publishing Ltd, 2023.
2. Generative AI for Cloud Solutions: Architect modern AI LLMs in secure, scalable, and ethical cloud environments, by Paul Singh, Anurag Karuparti ,Packt Publishing Ltd, 2024.

Web links and Video Lectures (e-Resources):

- https://www.w3schools.com/gen_ai/index.php
- <https://youtu.be/eTPiL3DF27U>
- <https://youtu.be/je6AlVeGOV0>
- <https://youtu.be/RLVqsA8ns6k>
- <https://youtu.be/0SAKM7wiC-A>
- https://youtu.be/28_9xMyrdjg
- <https://youtu.be/8iuiiz-c-EBw>
- <https://youtu.be/7oQ8VtEKcgE>
- <https://youtu.be/seXp0VWWZV0>

DEVOPS		Semester	6
Course Code	BCSL657D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	Practical		
Course objectives:			
<ul style="list-style-type: none"> ● To introduce DevOps terminology, definition & concepts ● To understand the different Version control tools like Git, Mercurial ● To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment) ● To understand Configuration management using Ansible ● Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems 			
Sl.NO	Experiments		
1	Introduction to Maven and Gradle: Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup		
2	Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins		
3	Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation		
4	Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle		
5	Introduction to Jenkins: What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use		
6	Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests		
7	Configuration Management with Ansible: Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook		
8	Practical Exercise: Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins		
9	Introduction to Azure DevOps: Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project		
10	Creating Build Pipelines: Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports		
11	Creating Release Pipelines: Deploying Applications to Azure App Services, Managing Secrets and Configuration with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines		
12	Practical Exercise and Wrap-Up: Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A		
Course outcomes (Course Skill Set):			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> ● Demonstrate different actions performed through Version control tools like Git. ● Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle. ● Experiment with configuration management using Ansible. ● Demonstrate Cloud-based DevOps tools using Azure DevOps. 			

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:

- <https://www.geeksforgeeks.org/devops-tutorial/>
- <https://www.javatpoint.com/devops>
- <https://www.youtube.com/watch?v=2N-59wUIPVI>
- <https://www.youtube.com/watch?v=87ZqwoFe088>