BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

5th

Semester

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Object Oriented Modelling		
Course Code:	23CS5PCOOM	Total Contact Hours:	25
L-T-P:	2-0-1	Total Credits:	3

Unit No.	Topics	Hours
1	**Class Modeling:** Object and class concepts; Link and associations concepts; Generalization and inheritance. **Advanced Class Modeling:** Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages.	5
2	**State Modeling:** Events, States, Transitions and Conditions; State diagrams; State diagram behaviour. **Advanced State Modeling:** Nested state diagrams; Nested states; Signal generalization; Concurrency.	5
3	**Interaction Modeling:** Use case models; Sequence models; Activity models. **Advanced interaction modeling:** Use case relationships; Procedural sequence models; **Special constructs for activity models.** **System Conception:** Devising a system concept; elaborating a concept; preparing a problem statement	5
4	**Domain Analysis:** Overview of analysis; Domain class model; Domain State Model; Domain Interaction Model; Iterating the analysis. **Application Analysis:** Application interaction model; Application class model; Application State Model; Adding operations.	5
5	**Design Patterns -** Introduction to patterns, Pattern categories; Relationships between patterns; Pattern description. **Communication Patterns:** Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.	5

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Object - Oriented Modeling and Design With UML	Michael Blaha, James Rumbaugh	2nd	Pearson Education	2007
2	Pattern-Oriented Software Architecture, A System of Patterns,	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal	1st	John Wiley and Sons	2007

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Pattern-Oriented Software Architecture: A System of Patterns	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal	1st	John Wiley and Sons	2006
2	Object-Oriented Analysis and Design with Applications	Grady Booch	3rd	Pearson Education	2007
3	Object-Oriented Analysis, Design and Implementation	Brahma Dathan, Sarnath Ramnath	1st	Universities Press	2009
4	UML 2 Toolkit	Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado	1st	Wiley-dreamtech India	2004

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Pattern-Oriented Software Architecture, A System of Patterns	Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal	1st	John Wiley and Sons	2007	https://daneshjavaji.wordpress.com/wp-content/uploads/2018/02/sznikak_jegyzet_pattern-oriented-sa_vol1.pdf
2	Object Oriented Analysis and Design with Applications	Grady Booch	3rd	Pearson Edition	2005	https://zjnu2017.github.io/OOAD/reading/Object.Oriented.Analysis.and.Design.with.Applications.3rd.Edition.by.Booch.pdf

| 3 | Object Oriented Analysis, Design and Implementation | Brahma Dathan, Sarnath Ramnath | 2ⁿᵈ | Universities Press | 2009 | https://link.springer.com /book/10.1007/9 78-3- 319-24280-4 |

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Object Oriented analysis and design	NPTEL	2024	https://archive.nptel.ac.in/cour ses/106/105/106105153/
2	Object-Oriented Design	Coursera	2024	https://www.coursera.org/learn /object-oriented-design

Course Outcomes (COs):

CO1	Apply the knowledge of class, State & Interaction Modelling using Unified Modeling Language to solve a given problem
CO2	Analyze a System for a given requirement using Unified Modeling language
CO3	Design a given system using high level strategy
CO4	Conduct practical experiment to solve a given problem using Unified Modeling language.

CO-PO-PSO- Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3											3		
CO3			3												
CO4				3	3					2			3		

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	**Best 2 of 3**	**20**
Quiz	**One**	**5**
Lab Component	**CIE + Lab test**	**25**
Alternate Assessment Tool (AAT)	**---**	**---**
Total		**50**

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Laboratory Plan:

Instructions to the students (Part A & B):

1. Develop a problem statement.
2. Develop a complete IEEE standard SRS document with several requirements.
3. Identity the conceptual classes and develop a domain model with UML Class diagram.
4. Identify the finite and appropriate states and develop an UML state diagram.
5. Identify Use Cases and develop the Use Case model.
6. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
7. Identify the business activities and develop an UML Activity diagram.

Sl. No.	Name of the Experiment
UML diagrams to be developed are:	
1	Class Diagram
2	Use Case Diagram
3	Sequence Diagram
4	State Diagram
5	Activity Diagram
PART-A **Applications Problems to be considered:**	
1	Hotel Management System
2	Credit Card Processing
3	Library Management System
4	Stock Maintenance System
5	Passport Automation System
PART-B	
Mini Project: Students must select a problem statement from Smart India Hackathon and must prepare SRS and design UML diagrams (With Simple UI).	

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Evaluation Rubrics for Mini Project:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Problem Statement and Software Requirements Specification (SRS)	(2) problem statement and software requirements are well defined and complete	(1) problem statement and software requirements are partially complete	(0.5) problem statement and software requirements are not complete	__/2
Design using UML	(3) UML diagrams are well designed	(2) UML diagrams are partially designed	(1) UML diagrams are not well designed.	__/3
User Interface (UI)	(2) User Interface (UI) is well designed	(1.5) User Interface (UI) is partially designed	(1) User Interface (UI) is not well designed	__/2
Oral communication. (presentation)	(1) Clear and effective communication Answers all the questions	(0.75) Communication is clear Answered most of the questions	(0.5) Unclear communication Answered only few of the questions	__/1
Report	(2) Clear and Effective writing and adherence to appropriate style guidelines	(1.5) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(1) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/2
Total				**__/10**

NOTE:

1. Students should come prepared with problem statement and SRS of the given problem to the lab.
2. Student should either stick the printout of problem statement and SRS or handwritten.
3. Students should complete all the specified UML diagrams for all the applications.

Evaluation Pattern: Part A(UML diagrams): 15 Marks
**   Part B(Mini Project)   : 10 Marks**

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SEE Exam Question Paper Format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Mandatory	One Question to be asked for 20 Marks
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	**Percentage of Questions to be Covered**
Remember / Understand	25%
Apply / Analyze	40%
Create / Evaluate	35%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Data Exploration and Visualization		
Course Code:	23CS5PCDEV	Total Contact Hours:	40
L-T-P:	2-1-0	Total Credits:	3

Unit No.	Topics	Hours
1	**Introduction to Exploratory Data Analysis (EDA)** - Steps in EDA, Data Types: Numerical Data - Discrete data, continuous data - Categorical data - Measurement Scales: Nominal, Ordinal, Interval, Ratio - Comparing EDA with classical and Bayesian Analysis - Software tools for EDA.	5
2	**Transformation Techniques:** Performing data deduplication - replacing values - Discretization and binning. Introduction to Missing data, handling missing data: Traditional methods - Maximum Likelihood Estimation.	5
3	**Descriptive Statistics:** Understanding statistics, Measures of central tendency, Measures of dispersion, Grouping Datasets Understanding groupby(), Groupby mechanics, Data aggregation, Pivot tables and cross-tabulations, Correlation: Introducing correlation, Types of analysis, Understanding, Correlation does not imply causation. **Types of analysis:** Univariate analysis - bivariate analysis - multivariate analysis. Time Series Analysis (TSA): Fundamentals of TSA - characteristics of TSA – Time based indexing - visualizing time series – grouping time series data - resampling time series data.	5
4	**Visualizing Data**: Mapping Data onto Aesthetics Data, Scales, Coordinate Systems and Axes, Directory of Visualizations, Visualizing Amounts, Visualizing Distributions: Histograms and Density Plots, Visualizing Multiple Distributions at the Same Time. **Visualizing Distributions:** Empirical Cumulative Distribution Functions and Q-Q Plots, Visualizing Many Distributions at Once, Visualizing Associations Among Two or More Quantitative Variables, Visualizing Uncertainty, Visualizing proportions.	5
5	**Getting Started with Pandas**: Arrays and vectorised computation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics. Data Loading, Storage and File Formats. Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases, Data Cleaning and Preparation. Handling Missing Data, Data Transformation, String Manipulation. Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting.	5

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Hands-On Exploratory Data Analysis with Python	Suresh Kumar Mukhiya, Usman Ahmed	1st	Packt	2020
2	Fundamental of Data Visualization	Claus O. Wilke	1st	O'Reilly	2019
3	Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.	McKinney. W	2nd	O'Reilly Media.	2017

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Data Exploration and Visualization	Anamitra Dehmukh, Nimbalkar	1st	Technical Publications	2022
2	Exploratory Data Analysis with Python	Ayodele Oluleye	1st	Packt	2023

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Data Visualization Exploring and Explaining with Data	Jeffery D Comm, James J Cochran, Michael J Fry	1st	Cengage	2022	https://www.perlego.com/book/3815910/data-visualization-exploring-and-explaining-with-data-pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Data Visualization	Coursera	2023	https://www.coursera.org/articles/data-visualization
2	Data Visualization	Edx	2023	http://edx.org/course/data-science-visualization

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Outcomes (COs):

CO1	Apply the computational approaches to perform Data Exploration and Visualization
CO2	Analyse the different techniques to perform Data Exploration and Visualization for a given application
CO3	Demonstrate exploratory data analysis to real data sets and provide interpretations through relevant visualization tools

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3													
CO3					3				3	3					

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	40
Quiz	---	---
Lab Component	---	---
Alternate Assessment Tool (AAT)	One	10
Total		50

Tutorial Plan:

Use data set of your choice from Open Data Portal for the following hands-on exercises.

Tutorial #	Topic
1	NumPy ndarray
2	Pandas Data Structures
3	Data Loading, Storage and File Formats
4	Interacting with Web APIs
5	Data Cleaning and Preparation
6	Data Wrangling
7	Data Visualization using matplotlib
8	Data Aggregation
9	Time Series Data Analysis
10-12	Analysing a real time dataset and draw meaningful insights using visualization tools

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

AAT Plan:

Plan of Activities: Following are the activities to be carried out by students during project work.

Sl. No	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 3 to 4
2	2nd and 3rd	Project topic selection by each group
3	4th	Presentation-1: Student and Project topic introduction by each group
4	5th	Data Acquisition and Data Preparation
5	6th and 7th	Presentation-2: Exploratory tools demonstration
6	8th and 9th	Presentation-3: Techniques applied on EDA
7	10th	Presentation-4: Visualization tools demonstration
8	11th	Complete Project Work Demonstration by each group
9	12th	Project Report Submission

Rubrics for Project Evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of the topic	(5-4) The topic chosen is relevant to the present scenario and is the emerging aspect pertaining to society.	(3-2) The topic chosen is relevant to the present scenario and is suitable to already prevalent events.	(1) The topic chosen is relevant to the present scenario and it has already been dealt with.	__/5
Data Acquisition and Data Preparation	(10-6) Students has acquired enough data with accurate data cleaning.	(5-3) Students has acquired enough data with little accurate data cleaning.	(2-1) Students has acquired enough data with least accurate data cleaning.	__/10
Presentation on tools used by each group	(5-4) Appropriate tools have been chosen to match the identified problem.	(3-2) Partially suitable tools have been chosen to match the identified problem.	(1) Unrelated tools have been chosen to match the identified problem.	__/5
Presentation on Reporting the findings	(10-6) Excellent result has been derived from the analysis with proper visualization.	(5-3) Good result has been derived from the analysis with proper visualization.	(2-1) Satisfactory result has been derived from the analysis with proper visualization.	__/10

Report	(5-4) Clear and Effective writing and adherence to appropriate style guidelines	(3-2) Clear and minor errors in writing and adherence to appropriate style guidelines	(1) Clear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/5
Oral communication (presentation)	(5-4) Clear and effective communication	(3-2) Communication is clear	(1) Unclear Communication	__/5
Total				**__/40**

Note: AAT will be evaluated for 40 marks and reduced to 10 marks.

SEE Exam Question paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Mandatory	One Question to be asked for 20 Marks
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Internal Choice	Two Questions to be asked for 20 Marks each

Bloom's Level	**Percentage of Questions to be Covered**
Remember / Understand	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Artificial Intelligence		
Course Code:	23CS5PCAIN	Total Contact Hours:	40
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	**Introduction:** Definition, Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents. Problem-solving: Problem-solving agents, Example problems, Searching for Solutions.	8
2	**Uninformed Search Strategies:** Breadth First search, Depth First Search, Iterative deepening depth first search, Hill Climbing, Simulated annealing and Monotonicity; Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions.	8
3	**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.	8
4	**Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. **Adversarial Search and Games**: Game playing - Classification of games - Optimal Decisions in Games - Prisoner's Dilemma – Game playing techniques - minimax search - Alpha-beta Tree search- Complexity of alpha-beta search-Monte carlo Tree Search-Stochastic Games - Partially Observable Games - Limitations of Game Search Algorithm.	8
5	**Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Semantics of Bayesian Networks.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Artificial Intelligence	Stuart J.Russell, Peter Norvig	3rd	Pearson	2015

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B Nair	3rd	Tata McGraw Hill	2013
2	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F Luger	5th	Pearson Education	2009

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Artificial Intelligence: Foundations of Computational Agents	David L. Poole, Alan K. Mackworth	2nd	Cambridge University Press	2017	https://www.kdnuggets.com/2019/11/10-free-must-read-books-i.html

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Knowledge-Based AI: Cognitive Systems	Udacity	2022	https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
2	Artificial Intelligence	NPTEL	2009	https://nptel.ac.in/courses/106/105/106105077/

Course Outcomes (COs):

CO1	Apply knowledge of agent architecture, searching and reasoning techniques for different applications
CO2	Analyse Searching and Inferencing Techniques
CO3	Design a reasoning and gaming system for a given requirement
CO4	Conduct practical experiments for demonstrating agents, searching and inferencing

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		2													
CO3			3												3
CO4				3											

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	20
Quiz	One	5
Lab Component	CIE + Lab Test	25
Alternate Assessment Tool (AAT)	---	---
Total		50

Laboratory Plan:

Instructions to Students:

1. Design, develop and implement the specified algorithms for the following problems using Python Language in LINUX / Windows environment.

2. Lab Observation - Handwrite the algorithm and output of program.

   Note: The faculty in charge of Artificial Intelligence course of all the sections must come up with two to three test cases for the programs in the laboratory set at the beginning of the semester. The students are expected to write the algorithm /program to solve these test cases. Depending on the number of test cases executed by the student the evaluation for the week must be done.

3. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	1	10	Implement Tic –Tac –Toe Game.
2	1	10	Solve 8 puzzle problems.
3	1	10	Implement Iterative deepening search algorithm.
4	1	10	Implement vacuum cleaner agent.
5	2	10	Implement A* search algorithm. Implement Hill Climbing Algorithm.

6	2	10	Write a program to implement Simulated Annealing Algorithm
7	3	10	Create a knowledge base using prepositional logic and show that the given query entails the knowledge base or not.
8	3	10	Create a knowledge base using prepositional logic and prove the given query using resolution.
9	4	10	Implement unification in first order logic.
10	4	10	Convert a given first order logic statement into Conjunctive Normal Form (CNF).
11	4	10	Create a knowledge base consisting of first order logic statements and prove the given query using forward reasoning.
12	4	10	Implement Alpha-Beta Pruning.

SEE Exam Question paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	Percentage of Questions to be Covered
Remember / Understand	25%
Apply / Analyze	50%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Computer Networks		
Course Code:	23CS5PCCON	Total Contact Hours:	40
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	**Introduction**: Data Communications, Networks, Network Types, Network Models, Protocol Layering, TCP/IP Protocol Suite, OSI Model. **Physical Layer:** Data and signals Digital Transmission, (D-D Conversion) Bandwidth Utilization, Multiplexing, Switching, Circuit Switched Networks, Packet Switching.	8
2	**Data Link Layer:** Link Layer Addressing, Error Detection and Correction, Block Coding, Cyclic Codes, Checksum. **Data Link Control:** DLC Services, Data-Link Layer Protocols, Media Access Control, Wired LANs, Ethernet protocol.	8
3	**Network Layer:** Network Layer Services, Packet Switching, Network Layer Performance, IPV4 Addresses. **Network Layer Protocols:** Internet Protocol, ICMPV4, Unicast Routing, Routing algorithms, Unicast routing protocols, Internet Structure, Routing Information Protocol (RIP), Next Generation IP: IPV6 Addressing, IPV6 Protocol, ICMPv6 Protocol, Transition from IPV4 to IPV6.	8
4	**Transport Layer**: Transport Layer Protocols, User Datagram Protocol, Transmission Control Protocol.	8
5	**Application Layer:** Introduction, Standard Client Server Protocols - World Wide Web and HTTP, Domain Name System (DNS), Network Management: Introduction, SNMP.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Data Communications and Networking	Behrouz A Forouzan	5th	McGraw Hill	2013

![BMS College logo]

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Data and Computer Communication	William Stallings	8th	Pearson Education	2008
2	Computer Networks – A Systems Approach	Larry L. Peterson, Bruce S. Davie	4th	Elsevier	2007

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Computer Networks	Andrew S. Tanenbaum, David J. Wetherall	5th	Pearson	2011	https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered by	Year	URL
1	Computer Networks and Internet Protocols	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc22_cs19/preview
2	Computer Networking	Coursera	2024	https://www.coursera.org/learn/illinois-tech-computer-networking

Course Outcomes (COs):

CO1	Apply the fundamental concepts of communication in networking
CO2	Analyze the various protocols, techniques in TCP/IP network architecture
CO3	Demonstrate the functionalities of TCP/IP layers

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3													
CO3			3		2									2	

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	20
Quiz	One	5
Lab Component	CIE + Lab test	25
Alternate Assessment Tool (AAT)	---	---
Total		50

Laboratory Plan:

Instructions to be followed by Students in each lab:

1. Each student should bring the observation book for each lab and write the programs and output completed in the previous week and gets it evaluated by the faculty in charge. In the observation book, students should

   a) Handwrite the Program/scenarios with topology and procedure
   b) Paste the printout of the Output or Handwrite the Output (Output should be written for all the cases).

2. Soft copy (PDF file) of all the experiments and programs along with the output needs to be submitted before the lab test.

3. Each Student should practice the extra exercise given in each lab.

NOTE:

CYCLE 1: Exercises done using CISCO Packet Tracer
CYCLE 2: Execution of Lab Programs using C/C++/Python

CYCLE-1		
Experiment #	**Unit #**	**Name of Experiment**
1	2	Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.
2	3	Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply
3	3	Configure default route, static route to the Router
4	5	Configure DHCP within a LAN and outside LAN.
5	3	Configure RIP routing Protocol in Routers
6	3	Configure OSPF routing protocol

7	3	Demonstrate the TTL/ Life of a Packet
8	5	Configure Web Server, DNS within a LAN.
9	2	To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)
10	5	To understand the operation of TELNET by accessing the router in server room from a PC in IT office.
11	3	To construct a VLAN and make the PC's communicate among a VLAN
12	3	To construct a WLAN and make the nodes communicate wirelessly

CYCLE-2		
Experiment #	**Unit #**	**Name of the Experiment**
13	2	Write a program for error detecting code using CRC-CCITT (16-bits).
14	4	Write a program for congestion control using Leaky bucket algorithm.
15	4	Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
16	4	Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
17	3,4,5	Tool Exploration –Wireshark

SEE Exam Question Paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	**Percentage of Questions to be Covered**
Remember / Understand	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	**Environmental studies**		
Course Code:	**23CV5HSEVS**		
L-T-P:	**1-0-0**	Total Credits:	**01**

Course Objective:

The course enables the students to develop a sense of responsibility about the environment, natural resources, their conservation, awareness about ill effects of pollution and understand the concept, structure and function of different ecosystems.

Course Outcome (COs):

CO1	Identify and discuss the components and impacts of human activities on environment, conservation and on protection of natural resources
CO2	Identify and establish relationship between social, economic and ethical values from environmental perspectives.

Unit - I:
Introduction to Environment: Definition, about Earth. Atmosphere, Hydrosphere, Lithosphere and Biosphere, Structure of Atmosphere, Internal structure of the Earth Ecosystem, Balanced ecosystem, types of Ecosystem Effects of Human activities on Environment. Environmental Impact Assessment (E I A)

Unit - II:
Natural Resources: Water resources its availability, Mineral resources, Forest resources.

Unit - III:
Energy resources: Conventional and Non-conventional energy resources. Hydroelectric, Wind power, solar, Biogas, Fossil fuel based energy resources – Coal, Oil & Gas, Nuclear power, Hydrogen as an alternate future sources of energy.

Unit - IV:
Environmental pollution: Effects and control of pollutions
    I.   Water pollution
   II.   Land pollution
  III.   Noise pollution.

Unit-V:
Current environmental issues & importance: Population growth effects & Control, Climatic changes, Global warming. Acid rain Ozone layer depletion & effects, Environmental protection; Role of Government, initiatives by Non-Govt. Organizations

15 hours

Text Books:

1. Dr. Geetha Balakrishanan, K G Lakshminarayana Bhatta, "Environmental studies", S M Publications, 5th Edition, 2017

2. N S Subramanyam, AV S S Sambamurthy, "Ecology", Alpha Science International Ltd, 2nd Edition, 2006

3. Dr. J.P.Sharma, "Environmental studies". Laxmi Publications, Third Edition, 2009

4. Smriti Srivastava, "Environment and Ecology", S K Kataria & Sons, 2023

References:

1. Benny Joseph, "Environmental Studies", Mc Graw Hill Education, 3rd Edition, 2017

2. Dr. D.L.Manjunath, "Environmental Studies", Pearson Education India, 3rd Impression, 2009

CIE: Two CIE to be conducted for 25 marks each, with MCQ 10 marks, descriptive 15 marks. Average of two to be considered.

SEE Paper Pattern: SEE to be conducted for 50 marks, with MCQ for 20 marks, descriptive for 30 marks. SEE may be online or offline

CO-PO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2	3								
CO2	2					2	3								

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	**Bio Inspired Systems**		
Course Code:	**23CS5BSBIS**	Total Contact Hours:	30
L-T-P:	**0-0-1**	Total Credits:	1

Introduction:

The course will expose students to the current research in several disciplines that relate to computer science, including computational neuroscience, cognitive science, biology, and evolutionary-inspired computational methods. These models have become important in several areas of computer science and the students will learn to develop models and algorithms to solve complex problems.

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Recent Developments in Biologically Inspired Computing	Leandro Nunes De Castro, Fernando Jose Von Zuben	2nd	Idea Group	2005
2	Handbook of bioinspired algorithms and applications	Stephan Olariu, Albert Y. Zomaya	1st	Chapman & Hall / CRC	2006

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Genetic algorithms in search optimization and machine learning	Goldberg	1st	Addison Wesley	1999
2.	Recent Advances in Swarm Intelligence and Evolutionary Computation	Xin-She Yang	1st	Springer International	2015

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Bio-inspired Artificial Intelligence Algorithms	Udemy	2023	https://www.udemy.com/course/bio-inspired-artificial-intelligence-algorithms-for-optimization/
2	AI and Meta-Heuristics (Combinatorial Optimization) Python	Udemy	2023	https://www.udemy.com/course/ai-and-combinatorial-optimization-with-meta-heuristics /?couponCode = SKILLS4SALEB

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Outcomes (Cos):

CO1	To analyse complex engineering problems and solve them by adapting biological processes suitably
CO2	To design and implement simple bio-inspired algorithms

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3			3								3		
CO2			3		3										

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	--	--
Quiz	--	--
Lab Component	CIE + Lab Test	50
Alternate Assessment Tool (AAT)	--	--
Total		50

Laboratory Plan:

Instructions to be followed by Students in each lab:

1. Every lab, the student will be evaluated for 10 marks

    a. If the student successfully finishes the assigned task of the lab and on spot task, in the stipulated lab hours, 10 marks will be given to the student.

    b. If the student could finish only assigned task in the stipulated lab hours then the student will get 8 marks.

    c. If the student could not complete the assigned task of that day lab, the student can show the completion on the same day or next day. The student will get 7 marks

    d. If the student could not complete as like Case 'c', then partial marks will be given based on the completion status.

    e. If the student is absent for the lab , he /she finished the assigned task and shows the execution before the next lab, the student will get 4 marks (Attendance will not be given)

    f. Note: Case 'e' is allowed only twice [Only if the student is absent because of illness]

2. Implement Following Algorithms using Python.

    Final CIE marks (50) will be allotted as follows: Continuous Evaluation (10 marks) + Record (5 marks) + Lab Test (35 marks).

Sl. No.	Algorithms
1	**Genetic Algorithm for Optimization Problems:** Genetic Algorithms (GA) are inspired by the process of natural selection and genetics, where the fittest individuals are selected for reproduction to produce the next generation. GAs are widely used for solving optimization and search problems. Implement a Genetic Algorithm using Python to solve a basic optimization problem, such as finding the maximum value of a mathematical function. **Implementation Steps:** 1. **Define the Problem:** Create a mathematical function to optimize. 2. **Initialize Parameters:** Set the population size, mutation rate, crossover rate, and number of generations. 3. **Create Initial Population:** Generate an initial population of potential solutions. 4. **Evaluate Fitness:** Evaluate the fitness of each individual in the population. 5. **Selection:** Select individuals based on their fitness to reproduce. 6. **Crossover:** Perform crossover between selected individuals to produce offspring. 7. **Mutation:** Apply mutation to the offspring to maintain genetic diversity. 8. **Iteration:** Repeat the evaluation, selection, crossover, and mutation processes for a fixed number of generations or until convergence criteria are met. 9. **Output the Best Solution:** Track and output the best solution found during the generations.
2	**Particle Swarm Optimization for Function Optimization:** Particle Swarm Optimization (PSO) is inspired by the social behavior of birds flocking or fish schooling. PSO is used to find optimal solutions by iteratively improving a candidate solution with regard to a given measure of quality. Implement the PSO algorithm using Python to optimize a mathematical function. **Implementation Steps:** 1. **Define the Problem:** Create a mathematical function to optimize. 2. **Initialize Parameters:** Set the number of particles, inertia weight, cognitive and social coefficients. 3. **Initialize Particles:** Generate an initial population of particles with random positions and velocities. 4. **Evaluate Fitness:** Evaluate the fitness of each particle based on the optimization function. 5. **Update Velocities and Positions:** Update the velocity and position of each particle based on its own best position and the global best position. 6. **Iterate:** Repeat the evaluation, updating, and position adjustment for a fixed number of iterations or until convergence criteria are met. 7. **Output the Best Solution:** Track and output the best solution found during the iterations.

3	**Ant Colony Optimization for the Traveling Salesman Problem:** The foraging behavior of ants has inspired the development of optimization algorithms that can solve complex problems such as the Traveling Salesman Problem (TSP). Ant Colony Optimization (ACO) simulates the way ants find the shortest path between food sources and their nest. Implement the ACO algorithm using Python to solve the TSP, where the objective is to find the shortest possible route that visits a list of cities and returns to the origin city. **Implementation Steps:** 1. **Define the Problem:** Create a set of cities with their coordinates. 2. **Initialize Parameters:** Set the number of ants, the importance of pheromone (alpha), the importance of heuristic information (beta), the evaporation rate (rho), and the initial pheromone value. 3. **Construct Solutions:** Each ant constructs a solution by probabilistically choosing the next city based on pheromone trails and heuristic information. 4. **Update Pheromones:** After all ants have constructed their solutions, update the pheromone trails based on the quality of the solutions found. 5. **Iterate:** Repeat the construction and updating process for a fixed number of iterations or until convergence criteria are met. 6. **Output the Best Solution:** Keep track of and output the best solution found during the iterations.
4	**Cuckoo Search (CS):** Cuckoo Search (CS) is a nature-inspired optimization algorithm based on the brood parasitism of some cuckoo species. This behavior involves laying eggs in the nests of other birds, leading to the optimization of survival strategies. CS uses Lévy flights to generate new solutions, promoting global search capabilities and avoiding local minima. The algorithm is widely used for solving continuous optimization problems and has applications in various domains, including engineering design, machine learning, and data mining. **Implementation Steps:** 1. **Define the Problem:** Create a mathematical function to optimize. 2. **Initialize Parameters:** Set the number of nests, the probability of discovery, and the number of iterations. 3. **Initialize Population:** Generate an initial population of nests with random positions. 4. **Evaluate Fitness:** Evaluate the fitness of each nest based on the optimization function. 5. **Generate New Solutions:** Create new solutions via Lévy flights. 6. **Abandon Worst Nests:** Abandon a fraction of the worst nests and replace them with new random positions. 7. **Iterate:** Repeat the evaluation, updating, and replacement process for a fixed number of iterations or until convergence criteria are met. 8. **Output the Best Solution:** Track and output the best solution found during the iterations.

5	**Grey Wolf Optimizer (GWO):** The Grey Wolf Optimizer (GWO) algorithm is a swarm intelligence algorithm inspired by the social hierarchy and hunting behavior of grey wolves. It mimics the leadership structure of alpha, beta, delta, and omega wolves and their collaborative hunting strategies. The GWO algorithm uses these social hierarchies to model the optimization process, where the alpha wolves guide the search process while beta and delta wolves assist in refining the search direction. This algorithm is effective for continuous optimization problems and has applications in engineering, data analysis, and machine learning. **Implementation Steps:** 1. **Define the Problem:** Create a mathematical function to optimize. 2. **Initialize Parameters:** Set the number of wolves and the number of iterations. 3. **Initialize Population:** Generate an initial population of wolves with random positions. 4. **Evaluate Fitness:** Evaluate the fitness of each wolf based on the optimization function. 5. **Update Positions:** Update the positions of the wolves based on the positions of alpha, beta, and delta wolves. 6. **Iterate:** Repeat the evaluation and position updating process for a fixed number of iterations or until convergence criteria are met. 7. **Output the Best Solution:** Track and output the best solution found during the iterations
6	**Parallel Cellular Algorithms and Programs:** Parallel Cellular Algorithms are inspired by the functioning of biological cells that operate in a highly parallel and distributed manner. These algorithms leverage the principles of cellular automata and parallel computing to solve complex optimization problems efficiently. Each cell represents a potential solution and interacts with its neighbors to update its state based on predefined rules. This interaction models the diffusion of information across the cellular grid, enabling the algorithm to explore the search space effectively. Parallel Cellular Algorithms are particularly suitable for large-scale optimization problems and can be implemented on parallel computing architectures for enhanced performance. **Implementation Steps:** 1. **Define the Problem:** Create a mathematical function to optimize. 2. **Initialize Parameters:** Set the number of cells, grid size, neighborhood structure, and number of iterations. 3. **Initialize Population:** Generate an initial population of cells with random positions in the solution space. 4. **Evaluate Fitness:** Evaluate the fitness of each cell based on the optimization function. 5. **Update States:** Update the state of each cell based on the states of its neighboring cells and predefined update rules. 6. **Iterate:** Repeat the evaluation and state updating process for a fixed number of iterations or until convergence criteria are met. 7. **Output the Best Solution:** Track and output the best solution found during the iterations.

7	**Optimization via Gene Expression Algorithms:**
	Gene Expression Algorithms (GEA) are inspired by the biological process of gene expression in living organisms. This process involves the translation of genetic information encoded in DNA into functional proteins. In GEA, solutions to optimization problems are encoded in a manner similar to genetic sequences. The algorithm evolves these solutions through selection, crossover, mutation, and gene expression to find optimal or near-optimal solutions. GEA is effective for solving complex optimization problems in various domains, including engineering, data analysis, and machine learning.
	Implementation Steps:
	1. **Define the Problem:** Create a mathematical function to optimize.
	2. **Initialize Parameters:** Set the population size, number of genes, mutation rate, crossover rate, and number of generations.
	3. **Initialize Population:** Generate an initial population of random genetic sequences.
	4. **Evaluate Fitness:** Evaluate the fitness of each genetic sequence based on the optimization function.
	5. **Selection:** Select genetic sequences based on their fitness for reproduction.
	6. **Crossover:** Perform crossover between selected sequences to produce offspring.
	7. **Mutation:** Apply mutation to the offspring to introduce variability.
	8. **Gene Expression:** Translate genetic sequences into functional solutions.
	9. **Iterate:** Repeat the selection, crossover, mutation, and gene expression processes for a fixed number of generations or until convergence criteria are met.
	10. **Output the Best Solution:** Track and output the best solution found during the iterations.

SEE Exam (50 Marks):

The student should execute the given bio-inspired algorithm and will be evaluated by external examiner along with internal faculty.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Robot Process Automation Design and Development		
Course Code:	23CS5PERPA	Total Contact Hours:	40
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	**Robotic Process Automation:** Scope and Techniques of automation: Techniques of automation Robotic Process Automation: Benefits of RPA Components of RPA, RPA platforms. About UiPath. The future of automation. **Record and Play:** UiPath stack, Downloading and Installing UiPath Studio, Learning UiPath Studio, Task Recorder, emptying trash in Gmail, Emptying Recycle Bin.	8
2	**Sequence, Flowchart, and Control Flow:** Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, to use a sequence, to use a flowchart, step by step example using sequence and control flow. **Data Manipulation:** Variables and scope, Collections, Arguments-purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example. CSV/Excel to data table and vice versa examples.	8
3	**Taking control of the controls:** Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls-mouse and keyboard activities, working with UiExplorer, Handling events, Revisit recorder, Screen scraping, when to use OCR, Types of OCR available, to use OCR, Avoiding typical failure points. **Tame that Application with Plugins and Extensions Terminal plugin:** Mail plugin, PDF plugin, web integration, Excel and Word plugins, Credential management.	8
4	**Handling User Events and Assistant Bots:** Assistant bots, monitoring system event triggers, monitoring image and element triggers, Launching an assistant bot on a keyboard event. **Exception Handling, Debugging, and Logging Exception handling:** Common exceptions and ways to handle them, Logging and taking screenshots, debugging techniques, Collecting crash dumps, Error reporting.	8
5	**Managing and Maintaining the Code:** Project Organization, Nesting workflows, Reusability of workflows, commenting techniques, State Machine, when to use Flowcharts, State Machines or sequences, Using config files and examples of a config file. **Deploying and Maintaining the Bot:** Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Learning Robotic Process Automation	Alok Mani Tripathi	1st	Packt	2018

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Robotic Process Automation Projects	Nandan Mullakara, Arun Kumar Asokan	1st	Packt	2020

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Learning Robotic Process Automation	Alok Mani Tripathi	1st	Packt	2018	https://book.akij.net/eBooks/2018/November/5be2a5c7bc9bd/Sanet.st_Learning_Robotic_Proc.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	RPA	UiPath	2016	https://www.uipath.com/developers/video-tutorials
2.	UiPath Tutorials for Beginners	Guru99	2024	https://www.guru99.com/uipath-tutorial.html

Course Outcomes (COs):

CO1	Apply the concept of Robotic Process Automation to automate various applications.
CO2	Analyse the usage of appropriate Robotic Process Automation technique for a given application.
CO3	Design and implement techniques of Robotic Process Automation.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														
CO2		3													
CO3			3		2				2	2				2	

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	40
Quiz	--	--
Lab Component	--	--
Alternate Assessment Tool (AAT)	One	10
Total		50

AAT Plan:

Under Alternate Assessment Tool component of Robotic Process Automation Design and Development course, students should carry out an application development using UiPath tool explore the practical applications of the concepts learned.

Plan of Activities:

Following are the activities to be carried out by students during project work:

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4
2	3rd	Project topic selection by each group
3	4th	Presentation: Student and Project topic introduction by each group
4	5th and 6th	Design Layout of the Application
5	7th	Presentation on Business process of the Application by each group
6	8th , 9th and 10th	Design and Development of the activities.
7	11th and 12th	Complete project Presentation of the Application developed
8	13th	Project Report Preparation

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Evaluation Rubrics:

Criteria	Exemplary	Proficient	Partially Proficient	Points
User Interface	(6-5) The Application has an exceptional design, attractive and usable interface. It is easy to locate all important elements.	(4-3) The Application have an attractive design and usable interface. It is easy to locate all important elements.	(2-1) The Application have a usable design interface, but may appear busy or boring. It is easy to locate most of the important elements.	__/6
Activity Design	(6-5) Design of an activity follows all the design best practices.	(4-3) Design of an activity follows most of the design best practices.	(2-1) Design of an activity follows very few of the design best practices.	__/6
Workflow	(6-5) All of the best practices of workflow such as (variable and argument naming, empty sequences or workflows, package restrictions, validation, managing error) followed.	(4-3) Most of the best practices of workflow such as (variable and argument naming, empty sequences or workflows, package restrictions, validation, managing error) followed.	(2-1) Few of the best practices of workflow such as (variable and argument naming, empty sequences or workflows, package restrictions, validation, managing error) followed.	__/6
Performance and reusability	(6-5) Performance and reusability is carried out for in all the Activity.	(4-3) Most of the activity performance is better and reusability is maintained.	(2-1) Few of the activity performance is better and reusability is maintained.	__/6

Report	(6-5) Clear and Effective writing and adherence to appropriate style guidelines	(4-3) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(2-1) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/6
Oral communication (presentation)	(5-4) Clear and effective communication	(3-2) Communication is clear	(1-0) Unclear communication	__/5
Participation in Discussions	(5-4) Provided many good ideas; inspired others; clearly communicated ideas, needs, and feelings.	(3-2) Participated in discussions; on some occasions, made suggestions.	(1-0) Listened mainly; Rarely spoke up, and ideas were off the mark.	__/5
Total				__/40

Note: AAT will be evaluated for 40 marks and reduced to 10 Marks.

SEE Exam Question paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	**Percentage of Questions to be Covered**
Remember / Understand	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Compiler Design		
Course Code:	23CS5PECPD	Total Contact Hours:	40
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	**Introduction, Lexical Analysis:** Language processors, The Structure of Compilers, Lexical analysis: The Role of Lexical Analyzer, Input Buffering, Specifications of Tokens, recognition of Tokens.	8
2	**Syntax Analysis:** Introduction, Parsing: Top-down Parsing, Bottom-up Parsing, Introduction to LR Parsing: Simple LR parser, More Powerful LR Parsers	8
3	Syntax-Directed Definitions, Evaluation order for SDDs, Applications of Syntax-directed translation, Syntax-directed translation schemes.	8
4	**Intermediate Code Generation:** Variants of syntax trees, Three-address code, Types and declarations, Translation of expressions, Control flow, Switch statements	8
5	**Run-Time Environments:** Storage Organization, Stack Allocation of Space. Code Generation: Issues in the design of Code Generator, The Target language, Addresses in the target code, Basic blocks and Flow graphs, Optimization of basic blocks, A Simple Code Generator.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Compilers Principles, Techniques and Tools	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman	2nd	Pearson Education	2012

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Compiler Design	K Muneeshwaran	1st	Oxford University Press	2012
2	Compiler Construction	K.V.N.Sunitha	1st	Pearson	2013
3	Engineering a Compiler	Keith Cooper, Linda Torczon	2nd	Morgan Kaufmann	2011

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction to Compilers and Language Design	Prof. Douglas Thain	2nd	Independently published	2023	https://www3.nd.edu/~dthain/compilerbook/compilerbook.pdf

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1	Compiler Design	NPTEL	2021	https://onlinecourses.nptel.ac.in/noc21_cs07/preview

Course Outcomes (COs):

CO1	Apply the concepts of Regular Expressions and grammar for tokenisation and rule checking
CO2	Analyse the syntax and semantic concepts of a compiler.
CO3	Design various types of parsers and Address code generation

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3													
CO3			2						2	2					

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	**Two**	**40**
Quiz	--	--
Lab Component	--	--
Alternate Assessment Tool (AAT)	**One**	**10**
Total		**50**

AAT Plan:

Students should implement a mini-project to demonstrate all the phases of the compiler learnt, using Lex/Yacc programming Language.

Sl. No.	Week	Activity
1	1st and 2nd	Formation of group. Note: Students groups of size 3 or 4 to be formed within the class
2	3rd	Project topic selection by each group
3	4th and 5th	Design the application chosen
4	6th, 7th, 8th and 9th	Implementation of the project
5	10th and 11th	Report
6	12th and 13th	Presentation of the project(Report and PPT)

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of code	(8-6) The chosen code covers the various complex code- covering most of the lexemes of the language, include different parser solution, code optimization and code generation and shows valid output	(5-3) The chosen code covers the various complex code - covering some of the lexemes of the language, include few parser solution, and code generation and shows valid output	(2-0) The chosen code covers the various complex code - covering some of the lexemes of the language, include few parser solution and code generation and shows wrong output	__/8
Selection of an appropriate PARSER	(8-6) The Parser technique chosen supports the implementation of all the concepts for the chosen code.	(5-3) The Parser technique chosen supports the implementation of most of the concepts for the chosen code.	(2-0) The Parser technique chosen supports the implementation of few of the concepts for the chosen code.	__/8
Design and Implementation of an application for the given code	(8-6) Design and Implementation has been done accurately using Applying all possible and suitable methods in all phases for the given problem statement and shows the valid output	(5-3) Design and Implementation has been done accurately using Applying few possible and suitable methods in all phases for the given problem statement and shows the valid output	(2-0) Design and Implementation has been done accurately using Applying all possible and suitable methods in all phases for the given problem statement and shows the wrong output	__/8

Report	(8-6) Clear and effective writing and adherence to appropriate style guidelines	(5-3) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(2-0) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/8
Oral communication (presentation)	(4-3) Clear and effective communication	(2) Communication is clear	(1-0) Unclear communication	__/4
Participation in Discussions	(4-3) Provided many good ideas; inspired others; clearly communicated Ideas.	(2) Participated in discussions; on some occasions, made suggestions.	(1-0) Listened mainly; Rarely spoke up, and ideas were off the mark.	__/4
Total				**__/40**

Note: AAT will be evaluated for 40 marks and reduced to 10 marks

SEE Exam Question paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Internal Choice	Two Questions to be asked for 20 Marks each

Bloom's Level	Percentage of Questions to be Covered
Remember / Understand	25%
Apply / Analyze	50%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Computer Graphics		
Course Code:	23CS5PECGH	Total Contact Hours:	40
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	**Computer Graphics Hardware:** Video Display Devices, Raster-Scan Systems, Graphics Networks, Graphics on the Internet. **Computer Graphics Software**: Coordinate Representations, Graphics Functions, Software Standards, Other Graphics Packages, Introduction to OpenGL. **Graphics Output Primitives**: Coordinate Reference Frames, Specifying a Two-Dimensional World-Coordinate Reference Frame in OpenGL, OpenGL Point Functions, OpenGL Line Functions, OpenGL Curve Functions.	8
2	Fill-Area Primitives, Polygon Fill Areas, OpenGL Polygon Fill-Area Functions, OpenGL Vertex Arrays, Pixel-Array Primitives, OpenGL Pixel-Array Functions, Character Primitives, OpenGL Character Functions, Picture Partitioning, OpenGL Display Lists, OpenGL Display-Window Reshape Function. **Attributes of Graphics Primitives**: OpenGL State Variables, OpenGL Color Functions, OpenGL Point-Attribute Functions, OpenGL Line-Attribute Functions, Curve Attributes, OpenGL Fill-Area Attribute Functions.	8
3	**Implementation Algorithms for Graphics Primitives and Attributes**: Line-Drawing Algorithms, Parallel Line Algorithms, Setting Frame-Buffer Values, Circle-Generating Algorithms. **Two-Dimensional Geometric Transformations**: Basic Two-Dimensional Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two-Dimensional Composite Transformations, Other Two-Dimensional Transformations, Raster Methods for Geometric Transformations.	8
4	**Two-Dimensional Viewing**: The Two-Dimensional Viewing Pipeline, The Clipping Window, Normalization and Viewport transformations, OpenGL Two-Dimensional Viewing Functions, Clipping Algorithms, Two-Dimensional Point Clipping, Two-dimensional Line Clipping (Cohen-Sutherland Line Clipping and Liang-Barsky Line Clipping), Polygon Fill-Area Clipping (Sutherland- Hodgman Polygon Clipping.	8

| 5 | **Three-Dimensional Viewing**: Overview of Three-Dimensional Viewing Concepts, The Three-Dimensional Viewing Pipeline, Three-Dimensional Viewing-Coordinate Parameters, Transformation from World to Viewing Coordinates, Projection Transformations, Orthogonal Projections, Perspective Projections, The Viewport Transformation and Three-Dimensional Screen Coordinates, OpenGL Three-Dimensional Viewing Functions, Three-Dimensional Clipping Algorithms, OpenGL Optional Clipping Planes. | 8 |

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Computer Graphics with OpenGL	Donald Hearn, M Pauline Baker	4th	Pearson Education Limited	2012

Reference book:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Computer Graphics using OpenGL	FS Hill, Stephen M Kelley	3rd	Pearson Education Limited	2007

E book:

Sl. No	Book Title	Authors	Edition	Link	Year
1	Computer Vision: Algorithms and Applications	Richard Szeliski	2nd	https://math.hws.edu /graphicsbook/	2022

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Computer Graphics	Edx	2024	https://www.edx.org/course/computer-graphics-2
2	Computer Graphics	NPTEL	2024	https://onlinecourses.nptel.ac.in/ noc20_cs90

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Outcomes (COs):

CO1	Apply suitable software modules for developing graphics applications using OpenGL.
CO2	Analyse various graphic transformation algorithms.
CO3	Design graphics-based applications using different transformations and viewing.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													2	3
CO2		3												2	
CO3			3						2	2				2	

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	40
Quiz	--	--
Lab Component	--	--
Alternate Assessment tool (AAT)	One	10
Total		50

AAT Plan:

Under AAT component, Students have to form teams of 3 or 4. Each team has to choose a theme and think of an efficient technique to appropriately design it. They are required to present their design and solution and also submit a concluding report.

AAT Week wise Plan:

Sl. No.	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 3 or 4
2	2nd and 3rd	Select a theme and submit.
3	4th	Survey and select appropriate design technique.
4	5th	Survey and select appropriate design technique.
5	6th and 7th	Implementation
6	8th and 9th	Implementation
7	10th	Implementation
8	11th	Complete Project Work Demonstration by each group
9	12th	Project Report Submission

![logo]

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Rubrics used for evaluation:

Criteria	Very Good	Good	Fair	Poor	Points
Animation and Rendering	(12-10) 2D/3D animation and rendering is done extremely well, works properly.	(9-7) 2D/3D animation and rendering is done well, works properly.	(6-4) 2D/3D animation and rendering is average, works properly for the most part.	(3-1) 2D/3D animation and rendering does not work properly or is not saved / rendered properly.	__/12
Model Complexity	(8-7) The model is complex and detailed and shows evidence of substantial sub-object modeling to define/refine modeled details.	(6-4) The model is mostly complex and detailed but lacks some evidence of sub-object modeling to define/refine modeled details.	(3-2) The model is mostly simplistic and lacks evidence of sub-object modeling to define/refine modeled details.	(1) Model design is inappropriate or overly simplistic.	__/8
Graphic Design & Visual Appearance	(10-8) 2D/3D model shows excellent design qualities and is aesthetically pleasing.	(7-5) 2D/3D model shows good design qualities and is aesthetically pleasing.	(4-3) 2D/3D model shows basic design qualities and is aesthetically acceptable.	(2-1) 2D/3D model shows poor design qualities and is not aesthetically acceptable.	__/10
Documentation and presentation	(10-8) Report is as per specified format and complete. The presentation is clear and effective and answered all queries.	(7-5) Report is completed and very contents are not as per format. The presentation is clear and answered some queries.	(4-3) Report is complete but does not follow the specified format. The presentation is clear.	(2-1) Report is incomplete and does not comply to the format specified. The presentation is unclear.	__/10
Total					**__/40**

Note: AAT will be evaluated for 40 marks and reduced to 10 marks.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SEE Exam Question paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Mandatory	One Question to be asked for 20 Marks
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	**Percentage of Questions to be Covered**
Remember / Understand	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Advanced Algorithms		
Course Code:	23CS5PEAAM	Total Contact Hours:	40
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	**Dynamic Programming**: Rod cutting, Matrix-chain multiplication, Longest common subsequence, Multistage graph, Longest increasing subsequence, Edit Distance, Egg Dropping Puzzle	8
2	**Maximum Flow:** Flow networks, The Ford-Fulkerson method, Maximum bipartite matching Multithreaded Algorithms: The basics of dynamic multithreading, Multithreaded matrix multiplication, Multithreaded merge sort	8
3	**String matching:** The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata. Input Enhancement in String Matching: The Knuth-Morris-Pratt algorithm	8
4	**Linear Programming**: Standard and slack forms, Formulating problems as linear programs, The simplex algorithm	8
5	**Computational Geometry:** Line-segment properties, Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points **Approximation Algorithms:** The traveling-salesman problem, the set-covering problem, The subset-sum problem	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Algorithms	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein	3rd	The MIT Press	2009
2	Introduction to the Design and Analysis of Algorithm	Anany Levitin	3rd	Pearson	2011

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahni, Rajasekharam	2nd	University Press Pvt. Ltd	2009

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Data structures and Algorithm Analysis in C++	Mark Allen Weiss	4th	Pearson Education	2014	http://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/ DataStructures.pdf

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1	Advanced Algorithms and Complexity	Coursera	2022	https://www.coursera.org /learn /advanced-algorithms-and-complexity

Course Outcomes (COs):

CO1	Apply appropriate algorithm techniques for various computing scenarios.
CO2	Analyse the complexity of given algorithm
CO3	Design efficient algorithms for a given problem by choosing appropriate design technique and implement the same.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3													3	
CO2		2												2	
CO3			3	2					2	2				3	

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	Best 2 of 3	40
Quiz	--	--
Lab Component	--	--
Alternate Assessment Tool (AAT)	One	10
Total		50

AAT Plan:

Students have to form teams of 3 to 4. Each team will select a problem. Student will have to think of an efficient design paradigm, appropriate data structure and solve the problem. They are required to present their solution and justify the technique used based on its efficiency. To conclude they will have to submit a report.

Plan of Activities:
Following are the activities to be carried out by students during project work:

Sl. No	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 3 to 4
2	2nd and 3rd	Selection of project topic.
3	4th	Time to analyse the problem and come up with appropriate design technique.
4	5th	Time to analyse the problem and come up with appropriate design technique.
5	6th and 7th	Implementation
6	8th and 9th	Implementation
7	10th	Implementation
8	11th	Complete Project Work Demonstration by each group
9	12th	Project Report Submission

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Algorithm Design	(10-7) An efficient algorithm is designed with appropriate design technique.	(6-4) An algorithm is designed with appropriate design technique.	(3-0) An algorithm is designed without concern to complexity	__/10

Implementation	(10-7) Correct implementation of the algorithm with appropriate data structures.	(6-4) Correct implementation of algorithm.	(3-0) Algorithm is not implemented in accordance with the design.	__/10
Oral communication (presentation)	(10-7) Clear and effective communication Answers all the questions	(6-4) Communication is clear Answered most of the questions	(3-0) Unclear communication Answered only few of the questions	__/10
Report	(10-7) Clear and Effective writing and adherence to appropriate style guidelines	(6-4) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(3-0) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/10
Total				**__/40**

Note: AAT will be evaluated for 40 marks and reduced to 10 marks.

SEE Exam Question Paper format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks

Bloom's Level	Percentage of Questions to be Covered
Remember / Understand	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Automated Software Testing		
Course Code:	23CS5AEAST	Total Contact Hours:	30
L-T-P:	0-0-1	Total Credits:	1

Guidelines:

- This course enables students to identify the requirements and develop the appropriate functional testing strategies for a given problem.

- The Student will be able to select appropriate tools that could be used to generate test cases.

- Students will also gain hands-on experience in generating test-cases, and verify the test cases as per the specification.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Software Testing: A Craftsman's Approach	Paul C. Jorgensen, Byron De Vries	5th	Auerbach	2022
2	Foundations of Software Testing	Aditya P Mathur	2nd	Pearson Education	2013
3	The Craft of Software Testing: Subsystems Testing Including Object-Based and Object-Oriented Testing	Brian Marrick	2nd	Pearson Education	2007

Tutorial Links:

1. https://nptel.ac.in/courses/106/105/106105150
2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
3. https://www.javatpoint.com/selenium-tutorial
4. Introduction to Selenium - https://www.youtube.com/watch?v=FRn5J31eAMw

Course Outcomes (COs):

CO1	Apply the concepts of software testing to assess the most appropriate testing method.
CO2	Analyze the Testing tool for various applications.
CO3	Design test-cases and automate testing using testing tool for a real-time application.
CO4	Demonstrate teamwork and problem-solving skills in project development.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												3		
CO2		3			3								3		
CO3			3		3								3		3
CO4								3	2	3					

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
Quiz	---	---
Lab Component	CIE + Mini Project	50
Alternate Assessment Tool (AAT)	---	---
Total		50

Weekly Activities and Delivery:

Sl. No.	Week	Activity	Content Deliverables by the Assigned Teacher	Technologies / Skills to be Covered
1	1st	Analyze the selenium tool and its usage in various application	Selenium Basics	Study of Web Testing tool Selenium
2	2nd	Consider a Bank application and study its system specifications and report the various bugs. Derive different test cases, execute these test cases and discuss the test results	Test-case generation	Selenium
3	3rd	Design Test Case for Inventory Management system (For Project): Formation of groups to be done. Note: Student groups of size 3 or 4	To give scenarios for designing Test-cases	Selenium

4	4th, 5th and 6th	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Review the topics	Develop a Mini Project with documentation of suitable test-cases and their results to perform automation testing of any real time application (Eg: E-commerce, social media web page)
5	7th, 8th, 9th, 10th and 11th	Presentation by each group	Review and Feedback	Suggested Guidelines: • Create a WebDriver session. • Navigate to a Web page. • Locate the web elements on the navigated page.
6	12th	Complete project work demonstration Project report preparation	Final Project Presentations and Submissions	• Perform an action on the located elements. • Assert the performed actions did the correct thing. • Report the results of the assertions. • End the session. Each inputs/data feed (ex: website, username, password, mobile no, product name, etc.,) must be provided through a file linked with code and neither to be entered manually nor to be included in the code Use any software testing tool like selenium, Katalon, etc.

Marks Distribution for the Course:
1) **Continuous Evaluation through reviews - 40 Marks**
   (Conducted for 40 Marks and reduced to 20 Marks)

2) **Mini-project - 60 Marks**

146

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Rubrics for Mini-Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Requirement Analysis & Designing	(15-13) Effectively contributed in requirement analysis and designing.	(12-9) Partially Contributed in requirement analysis and designing.	(8-5) Attempted to contribute in requirement analysis and designing	(4-0) No contribution in requirement analysis and designing	__/15
Developing a Solution with proper test cases	(20-15) Developed the critical modules with optimized coding and designed most test cases.	(14-10) Developed some modules with higher complexity in coding and designed few test cases.	(9-5) Attempted to develop few modules (case specific) and test cases.	(4-0) No contribution in developing a solution as well as testing.	__/20
Presentation	(15-13) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(12-9) Well-structured presentation with clear content and effective delivery.	(8-5) Basic presentation with some structure and varying delivery quality.	(4-0) Disorganized presentation lacking in coherence and adequate content.	__/15
Report & Documentation	(10-8) Comprehensive report covering all project aspects with meticulous documentation, including methodology, design, and future scope.	(7-5) Well-structured report with detailed coverage of project implementation.	(4-2) Basic report with limited content, covering essential project details.	(1-0) Poorly structured and incomplete report, lacking essential details.	__/10
Total					**__/60**

Note: The project will be evaluated for 60 marks and reduced to 30 marks.

SEE Exam (50 Marks):

Projects carried out by students will be evaluated by External examiner along with internal faculty.

147

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Competitive Coding		
Course Code:	23CS5AECCO	Total Contact Hours:	30
L-T-P:	0-0-1	Total Credits:	1

Introduction:

This course focuses on Competitive Coding with the focus on modelling and implementing for real world problems.

i. This course will deepen the understanding of problem solving skills that students have learnt in the previous courses such as Data Structures and Algorithms.

ii. Students will get confidence in hands-on problem-solving skill and will help in preparing for interviews, Hackathons, Google Talent Search, ACM ICPC.

iii. Competitive Programming Strategies such as Problem formulation, Time Complexity and Space Complexity analysis, Handling input/output efficiently especially for large datasets.

iv. The main objective of this course is to build a strong foundation in these areas through consistent practice and exploration of problem-solving techniques.

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	3rd	MIT Press	2009
2.	Competitive Programming 4 - Book 1: The Lower Bound of Programming Contests in the 2020	Steven Halim, Felix Halim, Suhendry Effendy	1st	Lulu.com	2020
3.	Competitive Programming 4 - Book 2: The Lower Bound of Programming Contests in the 2020	Steven Halim, Felix Halim, Suhendry Effendy	1st	Lulu.com	2020
4.	Elements of Programming Interviews: The Insiders' Guide	Adnan Aziz, Tsung-Hsien Lee, Amit Prakash	2nd	Amazon Digital Services	2016
5.	Cracking the Coding Interview: 189 Programming Questions and Solutions	Gayle Laakmann McDowell	6th	HYESHOM	2019

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Getting Started with Competitive Programming	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc22_cs59/preview
2	Competitive Programming	Udemy	2022	https://www.udemy.com/course/competitive-programming/?couponCode=ACCAGE0923

Course Outcomes (COs):

CO1	Analyse complex problems using efficient algorithms and data structures
CO2	Design and implement various problems of different levels of complexity using algorithmic techniques
CO3	Perform effectively in teams, give clear presentations, and create well-organized documents

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3												3
CO2			3											3
CO3								1	1	1				

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
Quiz	---	---
Lab Component	CIE + Lab Test	50
Alternate Assessment Tool (AAT)	---	---
Total		50

Laboratory Plan:

1. Students must take an online test based on topics such as Data Structures and Algorithms every week on the online platform provided by the institution.

2. **Teacher Guidance:** The teacher allotted should teach students various Algorithmic techniques and evaluate the progress and final outcomes of the assigned students.

3. CIE Evaluation will be done for 100 marks and will be reduced to 50 marks.
   Final CIE marks (50) will be allotted as follow: Regular lab (15 marks) + Test (35 marks)

SEE Exam (50 Marks):

Online Test will be conducted in the online platform provided by the Institution and evaluated.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	DevOps - Tools		
Course Code:	23CS5AEDOP	Total Contact Hours:	30
L-T-P:	0-0-1	Total Credits:	1

Guidelines:

1. **DevOps Implementation on Previous Projects:** Under this project work, students should apply DevOps principles and tools to previously developed full stack applications, data science applications, or machine learning applications. This includes setting up version control, continuous integration, continuous deployment, and containerization.

2. **Advanced Application Development:** Under this project work, students should extend their existing applications using technologies such as PHP, Python, Node.js, React, Angular, or any suitable front-end and back-end technologies, and integrate DevOps practices.

3. **Group Formation:** Students can form a group with a minimum of two and a maximum of four members to collaborate on the DevOps implementation project.

4. **Teacher Guidance:** The teacher allotted for project work should teach students various DevOps tools such as Git, GitHub, Docker, Jenkins, GitHub Actions, etc., during class/lab hours as per the allotment. The teacher should guide the students in choosing the appropriate DevOps strategies and tools, assist them in applying these tools to their projects, and evaluate the progress and final outcomes of the assigned students.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	A Beginners guide to DevOps Basics	Swatee Chand	1st	Edureka	2022
2	The DevOPS Handbook: How to Create World	Gene Kim, Jez Humble, Patrick Debois, John Allspaw, John Willis	2nd	It Revolution Press	2021

Tutorial Links:

1. https://www.coursera.org/learn/intro-to-devops

2. https://www.udacity.com/course/intro-to-devops--ud611

3. https://www.classcentral.com/subject/devops

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Outcomes (COs):

CO1	Implement version control systems and manage code repositories effectively, along with containerization using Docker.
CO2	Design and implement CI/CD pipelines for automated testing, integration, and deployment.
CO3	Participate effectively in team projects, deliver clear presentations, and create well-structured reports.

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3		3								3	3	
CO2			3		3								3	3	
CO3								3	3	3					

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
Quiz	---	---
Lab Component	CIE through Reviews	50
Alternate Assessment Tool (AAT)	----	--
Total		50

Laboratory Plan:

Sl. No.	Week	Activity	Content Deliverables by the Assigned Teacher	Technologies/Skills to be Covered
1	1st	Formation of groups. Note: Student groups of size 2 or 3 or 4	Introduction to DevOps and Project Setup	Overview of DevOps principles and tools, Introduction to version control using Git
2	2nd	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Version Control and Repository Setup	Creating and managing repositories on GitHub, Branching and merging strategies, Basic Git commands

151

3	3rd	Initial project setup	Containerization Basics	Introduction to Docker, Writing Dockerfiles, Building and running Docker containers
4	4th , 5th and 6th	Frontend and backend development	Advanced Docker Techniques	Multi-stage builds, Docker Compose for multi-container applications, Managing data volumes and networks
5	7th , 8th and 9th	CI/CD Pipeline Setup	Continuous Integration and Deployment	Setting up CI/CD pipelines using GitHub Actions or Jenkins, Automated testing and deployment, Integrating with Docker
6	10th	Presentation by each group	Mid-term Review and Feedback	Review of CI/CD pipeline implementations, Providing feedback for improvement, Troubleshooting CI/CD issues
7	11th	Complete project work demonstration	Continuous Deployment Strategies	Deploying applications to free cloud hosting providers (Heroku, Netlify, etc.), Rollback strategies, Monitoring deployments
8	12th	Project report preparation	Final Project Presentations and Submissions	Comprehensive report on DevOps implementation, Demonstrating CI/CD pipelines, Containerization and deployment strategies, Best practices for DevOps

Rubrics for Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Version Control	(14-12) Advanced use of version control with clear commit messages, proper code review, and effective collaboration.	(11-10) Effective use of version control with regular commits, proper branching, and merging strategies.	(9-5) Basic version control implemented with some commits and branches.	(8-0) Little or no use of version control.	__/14
Containerization using Docker	(14-12) Advanced use of Docker with multi-stage builds, efficient use of Dockerfile instructions, optimized image sizes, and automated container management.	(11-10) Effective use of Docker with well-structured Dockerfiles, proper use of volumes and networks, and container orchestration using Docker Compose or similar tools.	(9-5) Basic use of Docker with functional Dockerfiles, containerized application components, and use of Docker Hub for image storage.	(8-0) Little or no use of Docker for containerization.	__/14
Continuous Integration	(24-20) Advanced continuous integration setup with automated testing, code quality checks, and immediate feedback on failures.	(19-15) Consistent implementation of continuous integration with automated builds and test execution.	(14-7) Basic setup for continuous integration, but builds may fail occasionally.	(6-0) No implementation of continuous integration.	__/24
Deployment Automation	(20) Advanced automated deployment with zero-downtime deployment, canary releases, and blue/green deployment.	(19-15) Automated deployment for multiple environments with rollback capability.	(14-9) Basic automated deployment for specific environments.	(8-0) Manual deployment process.	__/20

Group Participation	(10) Active engagement, strong collaboration, and effective teamwork demonstrated throughout the project.	(9-7) Regular participation, constructive contributions, and collaboration within the group.	(6-4) Minimal participation with occasional contribution to group activities.	(3-0) Lack of active participation and collaboration within the group.	__/10
Presentation	(8) Professional presentation with engaging delivery, effective visuals, and comprehensive content.	(7-6) Well-structured presentation with clear content and adequate delivery.	(5-3) Basic presentation with limited structure and inconsistent delivery.	(2-0) Incoherent and disorganized presentation with inadequate content.	__/8
Report & Documentation (10 marks)	(10) Comprehensive and well-documented report covering all aspects of the project, including methodology, design, implementation, and future scope.	(9-6) Well-structured report/documentation covering project details and implementation.	(5-3) Basic report/documentation with limited content and organization.	(2-0) Poorly structured and incomplete report/documentation.	__/10
Total					**__/100**

Note: CIE will be conducted for 100 marks and reduced to 50 marks

SEE Exam (50 Marks):

Projects carried out by students will be evaluated by External examiner along with internal faculty.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	5		
Course Title:	Mini Project		
Course Code:	23CS5PWMIP	Total Contact Hours:	30
L-T-P:	0-0-2	Total Credits:	2

Guidelines:

- Implementation of Research Papers: Under this mini project work student should refer recent Journal papers, transaction papers [IEEE, Springer, Elsevier, etc.] of interested domain, implement the algorithms and technologies mentioned in the paper.

- Students can form a group with team size 3 to 4.

- Teacher allotted for mini project work should guide the students on the topic selected and towards carrying out mini project work and complete the evaluation of assigned students.

- Continuous evaluation of the project is carried out by the faculty and the final CIE is calculated as the sum of the 3 reviews conducted.

Course Outcomes (COs):

CO1	Analyze the research techniques and algorithms mentioned in the technical paper.
CO2	Design and develop a mini project using their domain knowledge and technologies to solve societal and engineering problems.
CO3	Document and present the implemented solutions in a team.

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				2										
CO2			3		3								1	2	1
CO3								1	2	1					

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
QUIZ	---	---
Lab Component	CIE through Reviews	50
Alternate Assessment Tool (AAT)	---	---
Total		50

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Weekly Activities and Delivery:

Sl. No	Week	Activity	Content deliverables by the assigned teacher
1	1st	Formation of groups. Note: Student groups of size 3 or 4	Introduction to research process and domain for selecting technical paper.
2	2nd	Project topic selection by each group	Discuss the techniques/algorithms mentioned in the referred paper.
3	3rd	Presentation: Student and Project topic introduction by each group	Verify the study of existing system and proposed system techniques from the paper.
4	4th, 5th and 6th	25% of the project work carried out	Review the work carried out.
5	7th	Presentation on the working model of the proposed work (25%) by each group	Review the work carried out.
6	8th and 9th	50% of the project work carried out	Review the complete work.
7	10th	Discussion on Results of the complete work carried out	Validation of all the results obtained.
8	11th	Complete project work carried out with relevant modules and features	Final Presentation and evaluation.
9	12th	Project Report Preparation and plagiarism report	---

Rubrics for Mini Project Evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Problem Formulation and Objectives	(10-8) Problem formulation and all objectives of the proposed work are well defined. Steps to be followed to solve the defined problem are clearly specified. The proposed solution is sustainable.	(7-4) Incomplete Problem formulation and justification to the objectives proposed. Steps are mentioned, but unclear.	(3-1) Problem formulation and objectives of the proposed work are either not identified or not well defined Incomplete and improper specification	__/10

156

![BMS College logo]

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Analyze the algorithms and techniques	(10-8) All algorithms / techniques are analyzed appropriately in accordance to the requirements.	(7-4) All algorithms / techniques are analyzed moderately in accordance to the requirements.	(3-1) Some of the algorithms / techniques are not analyzed in accordance to the requirements.	__/10
Design of the modules for the application	(20-16) All modules are designed appropriately in accordance to the requirements.	(15-8) All modules are designed moderately in accordance to the requirements.	(7-1) Some of the modules are not designed in accordance to the requirements.	__/20
Technical Implementation	(15-10) Implementation of modules using appropriate features for all set objectives showcasing efficiency, integrity, scalability, sustainability and technical excellence.	(9-6) Implementation of modules using appropriate features for most of the set objectives showcasing integrity, scalability, sustainability and technical excellence.	(5-1) Some of the modules are implemented in accordance with the design.	__/15
Demonstration of the project	(10-8) Demonstrates the functionality of the application using appropriate reports or results for various cases.	(7-4) Demonstrates the functionality of the application using appropriate reports or results for few cases.	(3-1) Demonstrates the functionality of the application without much reporting or results.	__/10
Group Participation (10)	(10-8) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(7-4) Consistent participation and constructive collaboration within the group.	(3-1) Minimal but noticeable participation and occasional contributions.	__/10

Presentation	(10-8) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(7-4) Well-structured presentation with clear content and effective delivery.	(3-1) Basic presentation with some structure and varying delivery quality.	__/10
Project and plagiarism report	(15-12) Clear and Effective writing and adherence to appropriate style guidelines and percentage of plagiarism <=20.	(11-6) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines and percentage of plagiarism between 20 to 40.	(5-1) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines and percentage of plagiarism >40.	__/15
Total				**__/100**

Note: CIE will be conducted for 100 marks and reduced to 50 marks.

SEE Exam (50 Marks):

Evaluation of Projects will be carried out by External examiner along with internal faculty.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
(Autonomous College under VTU Belagavi)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING