ಬಿ. ಎಂ. ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

B.M.S. COLLEGE OF ENGINEERING, BANGALORE - 19

(Autonomous College under VTU)

Department of Computer Science and Engineering

Scheme and Syllabus for
III to VIII Semester
For the 2022 Admitted Batch onwards

ಬಿ. ಎಂ. ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು – **560 019**

B.M.S. COLLEGE OF ENGINEERING, BANGALORE - 19

Bull Temple Road, Bangalore - 560 019

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

VISION OF INSTITUTE

Promoting Prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training

MISSION OF INSTITUTE

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society.

DEPARTMENT VISION & MISSION

VISION

To be a model centre for education and training in the frontier areas of Computer Science and Engineering.

MISSION

- To Educate and Empower the students in the area of Computer Science by providing best practices of Teaching Learning Process for successful professional career.
- To enhance skills of the students to pursue higher studies and research.
- To foster the students to innovate and nurture them towards Entrepreneurship.

COURSE TYPES:

Basic Science Course	BS
Engineering Science Course	ES
Professional Core Course	PC
Professional Elective Course	PE
Group Core	GC
Cluster Core	CC
Open Elective Course	OE
Project / Mini-Project	PW
Seminar–Internship	SR
Humanities and Social Sciences, Management Course	HS
Non-Credit Mandatory Course	NCMC

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Curricular Component/ Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BS)	8	8	3	3	1	--	--	--	23
Engineering Science Course (ES)	9	9	3	3	--	--	--	--	24
Professional Core Course (PC)	--	--	15	14	14	11	6	--	60
Professional Elective Course (PE)	--	--	--	--	3	3	3	3	12
Open Elective Course (OE)	--	--	--	--	--	3	3	3	9
Project/ Mini-Project (PW)	--	--	--	--	2	2	8	--	12
Internship (Re/Ru/In)	--	--	--	--	--	--	--	6	6
Humanities and Social Sciences, Management Course (HS)	1	1	--	--	1	--	--	--	3
Ability Enhancement Course /SDC	2	2	1	1	1	3	--	--	10
UHV Courses(AE)	--	--	--	1	--	--	--	--	1
Non-Credit Mandatory Course	--	--	NC	NC	NC	NC	--	--	--
Total Credits	20	20	22	22	22	22	20	12	160

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Semester-III

No.	Course Type	Code	Course Title	Credits			Total Credits	Total Hours
				L	T	P		
1	BS	23MA3BSSDM	Statistics and Discrete Mathematics	2	1	0	3	4
2	ES	23CS3ESCOA	Computer Organization and Architecture	3	0	0	3	3
3	PC-1	23CS3PCOOJ	Object Oriented Java Programming	3	0	1	4	5
4	PC-2	23CS3PCLOD	Logic Design	2	0	0	2	2
5	PC-3	23CS3PCDBM	Database Management Systems	3	0	1	4	5
6	PC-4	23CS3PCDST	Data Structures	3	0	1	4	5
7	PC-5	23CS3PCUSP	Unix Shell Programming	0	1	0	1	2
8	AE/SDC	23CS3AEFWD	Full Stack Web development	0	0	1	1	2
		23CS3AETEW	Technical Writing					
		23CS3AEASL	Assembly Language					
9	NCMC	23NCMC3NS1	NSS	0	0	0	0	0
		23NCMC3YG1	YOGA					
		23NCMC3PE1	Physical Edu. (Sports and Athletics)					
TOTAL				**16**	**2**	**4**	**22**	**28**

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Semester-IV

No.	Course Type	Code	Course Title	Credits			Total Credits	Total Hours
				L	T	P		
1	BS	23MA4BSLAO	Linear Algebra and Optimization	2	1	0	3	4
2	ES	23CS4ESCRP	Cryptography	3	0	0	3	3
3	PC	23CS4PCTFC	Theoretical Foundations of Computations	2	1	0	3	4
4	PC	23CS4PCOPS	Operating Systems	3	0	1	4	5
5	PC	23CS4PCADA	Analysis and Design of Algorithms	3	0	1	4	5
6	PC	23CS4PCSED	Software Engineering	3	0	0	3	3
7	UHV	22MA4AEUHV	Universal Human Values	0	1	0	1	2
8	AE	23CS4AEMAD	Mobile Application Development	0	0	1	1	2
		23CS4AEUIX	UI/UX Design					
		23CS4AEHID	Hardware interface design					
9	NCMC	23NCMC4NS2	NSS	0	0	0	0	0
		23NCMC4YG2	YOGA					
		23NCMC4PE2	Physical Edu. (Sports and Athletics)					
TOTAL				**16**	**3**	**3**	**22**	**28**

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Semester-V

No.	Course Type	Code		Course Title	Credits			Total Credits	Total Hours
					L	T	P		
1	PC	23CS5PCOOM		Object Oriented Modelling	2	0	1	3	4
2	PC	23CS5PCDEV		Data Exploration and Visualization	2	1	0	3	4
3	PC	23CS5PCAIN		Artificial Intelligence	3	0	1	4	5
4	PC	23CS5PCCON		Computer Networks	3	0	1	4	5
5	HS	23CV5HSEVS		Environmental Studies	1	0	0	1	1
6	BS	23CS5BSBIS		Bio Inspired Systems	0	0	1	1	2
7	PE	23CS5PE XXX	RPA	Robot Process Automation Design and Development	3	0	0	3	3
			CPD	Compiler Design					
			CGH	Computer Graphics					
			AAM	Advanced Algorithms					
8	AE	23CS5AEAST		Automated Software Testing	0	0	1	1	2
		23CS5AECCO		Competitive Coding					
		23CS5AEDOP		DevOps -Tools					
9	PW	23CS5PWMIP		Mini Project	0	0	2	2	4
10	NCMC	23NCMC5NS3		NSS	0	0	0	P/NP	
		23NCMC5YG3		YOGA					
		23NCMC5PE3		Physical Edu. (Sports and Athletics)					
				Details of 40 AICTE Activity Points					
TOTAL					**14**	**1**	**6**	**22**	**30**

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Semester-VI

No.	Course Type	Code		Course Title	Credits			Total Credits	Total Hours
					L	T	P		
1	PC	23CS6PCCCT		Cloud Computing	2	1	0	3	4
2	PC	23CS6PCBDA		Big Data Analytics	3	0	1	4	5
3	PC	23CS6PCMAL		Machine Learning	3	0	1	4	5
4	AE	23CS6AERML		Research Methodology and IPR	3	0	0	3	3
5	PE	23CS6PE XXX	ACN	Advanced Computer Networks	3	0	0	3	3
			BLC	Blockchain Technology					
			CVI	Computer Vision and Image Processing					
			ADS	Advanced Data Structures					
6	OE	23CS6OE XXX	AIN	Artificial Intelligence	3	0	0	3	3
			CRP	Cryptography					
			DST	Data Structures using C					
			RPA	Robot Process Automation Design and Development					
7	PW-1	*23CS6PWPP1*		*Major Project Phase-1*	0	0	2	2	4
8	NCMC	23NCMC6NS4		NSS	0	0	0	P/NP	
		23NCMC6YG4		YOGA					
		23NCMC6PE4		Physical Edu. (Sports and Athletics)					
				Details of 60 AICTE Activity Points Earned					
TOTAL					**17**	**1**	**4**	**22**	**27**

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Semester-VII

No.	Course Type	Code		Course Title	Credits			Total Credits	Total Hours
					L	T	P		
1	PC	23CS7PCNWP		Network Programming	2	1	0	3	3
2	PC	23CS7PCMNE		Management and Entrepreneurship	3	0	0	3	3
3	PE	23CS7PE XXX	SWA	Software Architecture	3	0	0	3	3
			SCN	Soft Computing					
			NLP	Natural Language Processing					
			WMC	Wireless and Mobile Communication					
4	OE	23CS7OE XXX	MAL	Introduction to Machine Learning	3	0	0	3	3
			INS	Information and Network security					
			ADA	Analysis and design of Algorithms					
5	PW	*23CS7PWPP2*		*Major Project Phase-2*	0	0	8	8	16
				Details of 80 AICTE Activity Points Earned					
TOTAL					**11**	**1**	**8**	**20**	**28**

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Semester-VIII

No.	Course Type	Code		Course Title	Credits			Total Credits	Total Hours
					L	T	P		
1	PE	23CS8PE XXX	NES	Network Security	3	0	0	3	3
			NDL	Neural network and Deep Learning					
			VAR	Virtual & Augmented Reality					
			HPC	High Performance Computing					
2	OE	23CS8OE XXX	DEL	Deep Learning	3	0	0	3	3
			CYS	Cyber Security					
			OOJ	Object Oriented Programming with Java					
3	INT	23CS8SRINT		Internship	0	0	6	6	12
				Details of 100 AICTE Activity Points Earned					
TOTAL					**6**	**0**	**6**	**12**	**18**

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3rd Semester

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Semester:	**3**		
Course Title:	**Statistics and Discrete Mathematics**		
Course Code:	**23MA3BSSDM**		
L-T-P:	**2-1-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**GRAPH THEORY: Basic Concepts:** Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graphs, Hamiltonian graphs, sub-graphs, and Isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, minimal spanning tree: Kruskal's algorithm and shortest path-Dijkstra's algorithm	8
2	**Probability Distributions: Theoretical distributions: Discrete and continuous random variables:** Discrete distributions, Poisson distribution, Geometric distributions. Continuous distributions: Exponential, Gaussian, Uniform Distribution and Gamma distributions.	8
3	**Joint Probability And Markov Chain:** Joint Probability Distributions: Discrete and continuous joint random variables, Mathematical expectations, Covariance, and Correlation. Markov Chain: Probability vector, stochastic matrix, fixed point vector, regular stochastic matrix. Higher transition probabilities, stationary distribution of regular Markov chain.	8
4	**Statistical Inference:** Introduction, procedure for testing of hypothesis, level of significance. Large sample: Test of significance for single mean and difference between two means. Small sample: Test of significance for single mean, the difference between two means, paired t-test, ratio of variances (F-distribution) and Chi-Square goodness of fit.	8
5	**Combinatorics:** Introduction, Binomial and multinomial theorems, Catalan numbers, the principle of inclusion and exclusion, Derangements, Rook Polynomials.	7

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Graph Theory and Combinatorics	D. S. Chandrasekharaiah	4^{th}	Prism Engineering Education Series	2011-12

2	Higher Engineering Mathematics	B. V. Ramana		Tata McGraw Hill	2007
3	Discrete Mathematics and its applications	Kenneth H. Rosen	7th	McGraw Hill Publishers	

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Discrete Mathematics	Kolman, Busby Ross	5th	Prentice Hall	2004
2	Graph Theory with Applications to Engineering and Computer Science	Narsingh Deo	Eastern Economy	PHI Learning Pvt., Ltd	
3	Mathematics for Machine Learning	Marc Peter Deisennorth, A. Aldo Faisal, Cheng Soon Ong		Cambridge University Press	2020

E-books and online course materials:

1. http://jlmartin.faculty.ku.edu/~jlmartin/courses/math725-S16/
2. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/probability-intro
2. https://nptel.ac.in/courses/111104026/(DiscreteMathematics)
3. https://nptel.ac.in/courses/111106086/(Combinatorics)

Course Outcomes (COs):

CO1	Apply the concept of Discrete Mathematics and Statistics in Computer and Allied Engineering Science.
CO2	Demonstrate the Importance of Discrete Mathematics and Statistics using Modern IT Tools.

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

Tool	Remarks	Marks
Quiz	10	5
AAT	10	5
Test 1	40	20
Test 2	40	20
Total		**50**

SEE Exam Question paper format:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 3 & 5 and two questions each from Unit 1 and Unit 4.

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Semester:	**3**		
Course Title:	**Computer Organization and Architecture**		
Course Code:	**23CS3ESCOA**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Basic Structure of Computers Instruction Set Architecture:** Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes	8
2	**Introduction to Assembly Language:** Concepts, Stacks, Subroutines, Additional Instructions, Basic Input/Output: Accessing I/O Devices, Interrupts, Bus Structure, Bus Operation, Arbitration	8
3	**Memory System:** Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories: Mapping Functions, Virtual Memory	8
4	**Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers Fast Multiplication: Bit-Pair Recoding of Multipliers, Carry-Save Addition of Summands, Summand Addition Tree using 3-2 Reducers, Integer Division, Floating Point Numbers and Operations: Arithmetic Operations on Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations	8
5	**Basic Processing Unit:** Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Hardwired Control. **Parallel Processing and Performance:** Hardware Multithreading, Vector Processing, Shared memory Multiprocessors, Cache Coherence, Message Passing Multicomputer	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Computer Organization and Embedded Systems	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian	6th	Tata McGraw Hill	2012

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Computer Organization and Design-The Hardware/Software Interface	David A. Patterson, John L. Hennessy	5th	Elsevier	2013
2	Computer Organization & Architecture	William Stallings	11th	Pearson	2018

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Computer Organization and Design: The Hardware / Software Interface	David A. Patterson, John L. Hennessy	4th	Elsevier	2012	https://books.google.co.in/books?id=U6lpXmu7OngC&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1.	Computer Architecture and Organization	NPTEL	2021	https://onlinecourses.nptel.ac.in/noc21_cs61/preview

Course Outcomes (COs):

CO1	Apply the concepts of basic functional units to demonstrate the working of computational system.
CO2	Analyse the issues of the processor architecture to improve the efficiency in computer design.
CO3	Design memory modules and Arithmetic Logic unit for a given specification by analysing performance issues.

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

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

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%

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Semester:	**3**		
Course Title:	**Object Oriented Java Programming**		
Course Code:	**23CS3PCOOJ**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**The History and Evolution of Java:** The Byte code, Features of Java, An overview of Java: Object-Oriented Programming, Structure of a Java program Data Types, Variables and Arrays: The Primitive Types, Integers, Floating Point Types, characters, Booleans, Variables. Type conversion and casting, Arrays. **Classes**: Fundamentals, Declaring Objects, Assigning Object Reference Variables, Methods, Constructors, this Keyword, Garbage Collection, Stack application. **Methods and Classes**: Overloading Methods, Using Objects as Parameters, Argument Passing, Returning Objects, Access Control, static, final, Command-Line Arguments.	**8**
2	**Inheritance:** Basic concepts, Member Access and Inheritance, Practical Example. Inheritance types, super, constructors, Method Overriding, Dynamic Method Dispatch, Abstract Classes, final with inheritance. **String Handling:** String Constructor, String length, Special string Operations, Character Extraction, String comparison, Modifying a string, String Buffer. **Generics:** About Generics, A simple Generic Example, General class with Two Type Parameters, General form of generic class.	**8**
3	**Packages and Interfaces:** Packages, Packages and member access, Importing packages, Interfaces, Default interface methods, Use static methods in an interface, Private Interface methods. **Exception handling:** Fundamentals, Exception types, uncaught exceptions, try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, User-defined exceptions.	**8**
4	**Multithreaded Programming:** Java thread model, main thread, creating thread, creating multiple threads, isalive( ) and Join( ), thread priorities, synchronization. **Input/Output:** Exploring java.io - The I/O Classes and Interfaces, The Byte Streams.	**8**
5	**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model, Events- Event Sources, Event Listeners, Event Classes- The MouseEventClass, Event Listener Interfaces-The MouseListener Interface, the MouseMotionListener Interface, Delegation Event Model – Handling Mouse Events. AWT: Working with Windows, Graphics and Text. AWT Classes, Window Fundamentals, Working with Frame Windows, Graphics.	**8**

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Java: The Complete Reference	Herbert Schildt	11th	Tata McGraw-hill Edition	2019

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to JAVA Programming	Y. Daniel Liang	9th	Pearson Education	2012
2	Programming in JAVA 5.0	James P Cohoon, Jack W Davidson	1st	Tata McGraw Hill	2006
3	Programming with Java: A Primer	E. Balagurusamy	5th	McGraw Hill Education	2014

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Java, Java, Java Object-Oriented Problem Solving	R. Morelli, R. Walde	3rd	Pearson Education	2012	https://ia800303.us.archive.org/26/items/JavaJavaJavaObject-orientedProblemSolving/jjj-os.pdf
2	The Art and Science of Java	Eric S. Roberts	1st	Greg Tobin	2007	http://people.reed.edu/~jerry/121/materials/artsciencejava.pdf
3	Java Programming	Wikibooks Contributors	7th	wikibooks.org	2016	https://upload.wikimedia.org/wikipedia/commons/e/e7/Java_Programming.pdf
4	Think Java: How to Think like a Computer Scientist	Allen B. Downey, Chris Mayfield	1st	Green Tea Press Needham, Massachusetts	2016	https://greenteapress.com/thinkjava6/thinkjava.pdf

5	Introduction to Programming using Java	David J. Eck	7th	Create Space	2014	https://www.win.tue.nl/~wstomv/edu/sc-hse/downloads/general/javanotes7-linked.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Object Oriented Programming in Java	Coursera	2022	https://www.classcentral.com/course/coursera-object-oriented-programming-in-java-4212
2	Java Programming Basics	Udacity	2022	https://www.udacity.com/course/java-programming-basics--ud282
3	Java	NPTEL	2022	https://onlinecourses.swayam2.ac.in/aic20_sp13/preview

Course Outcomes (COs):

CO1	Apply the knowledge of Java concepts to find the solution for a given problem.
CO2	Analyse the given Java application for correctness/functionalities.
CO3	Develop Java programs / applications for a given requirement.
CO4	Conduct practical experiments for demonstrating features of Java.

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												
CO4			3		1					1					1

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:

1. Students should write the program / pseudocode for that week to be executed in the lab at the beginning of each lab and get it corrected by the batch-in-charge faculty and then start with the program execution.
2. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.
3. Continuous Internal Evaluation for each lab is for 10 marks which includes execution of the program in the allotted lab time and showing the output. Observation book needs to be corrected on the same day itself.

   Note:
   - Student completes the program on the day within the lab timings and shows the output for any given input case: 10 marks
   - Student completes the program on the day within the lab timings and shows the output for only some input cases: 8 marks
   - Student completes the program on the day and shows the output for any given input case: 6 marks Student completes the program on the day within one week and shows the output for any given input case: 4 marks
   - Submission any later: 0 marks
4. One Lab Test will be conducted, (mostly after theory Test-2). Lab Test will comprise programs which are completely different from the existing lab list of programs.
5. Marks split up for Lab:
   Continuous Internal Evaluation: **100 marks → reduced to 10 marks**
   Lab Test: **60 marks → reduced to 15 marks** (Writeup- 15 marks, Execution- 25 marks, Modification asked in the program for execution – 10 marks, Viva- 10 marks)

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	1	10	Develop a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c = 0$. Read in a, b, c and use the quadratic formula. If the discriminate b^2-4ac is negative, display a message stating that there are no real solutions.
2	1	10	Develop a Java program to create a class Student with members usn, name, an array credits and an array marks. Include methods to accept and display details and a method to calculate SGPA of a student.
3	1	10	Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString( ) method that could display the complete details of the book. Develop a Java program to create n book objects.

4	2	10	Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea() that prints the area of the given shape.
5	2	10	Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed. Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks: a) Accept deposit from customer and update the balance. b) Display the balance. c) Compute and deposit interest d) Permit withdrawal and update the balance Check for the minimum balance, impose penalty if necessary and update the balance.
6	3	10	Create a package CIE which has two classes - Personal and Internals. The class Personal has members like usn, name, sem. The class Internals has an array that stores the internal marks scored in five courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Personal. This class has an array that stores the SEE marks scored in five courses of the current semester of the student. Import the two packages in a file that declares the final marks of n students in all five courses.

7	3	10	Write a program that demonstrates handling of exceptions in inheritance tree. Create a base class called "Father" and derived class called "Son" which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age<0. In Son class, implement a constructor that uses both father and son's age and throws an exception if son's age is >=father's age.
8	4	10	Write a program which creates two threads, one thread displaying "BMS College of Engineering" once every ten seconds and another displaying "CSE" once every two seconds.
9	Open Ended Exercise	10	Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.
10	Open Ended Exercise	10	Demonstrate Inter process Communication and deadlock

Note: Collect a report for the open-ended exercise

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	20%
Apply / Analyze	50%
Create / Evaluate	30%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

(Autonomous College under VTU Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Logic Design**		
Course Code:	**23CS3PCLOD**	**Total Contact Hours:**	**25**
L-T-P:	**2-0-0**	**Total Credits:**	**2**

Unit No.	Topics	Hours
1	**Simplification of Boolean Expressions:** Boolean expressions and Notations, Karnaugh Maps- Up to Four-variable maps, Product and Sum term Representations on Karnaugh Maps, Minimization using Karnaugh Maps to obtain Minimal Expressions for Complete Boolean Functions, Minimal Sum and Product with Don't Care Conditions, The Quine-McClusky Method.	**5**
2	**Combinational Circuits:** Comparators, Decoders, Encoders, Multiplexers, Demultiplexers.	**5**
3	**Programmable Logic Devices (PLDs):** PLD Notation, Programmable Read-Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL).	**5**
4	**Flip-Flops:** The Basic Bistable Element, Latches-SR Latch, The Gated D Latch, The Master Slave JK Flip Flop, Edge Triggered Flip Flops, Timing Diagram of Flip Flops, Characteristic equation of Flip Flops.	**5**
5	**Counters and Design of Synchronous Sequential Circuits:** Introduction to Counters-Binary Ripple Counters, Design of Synchronous Counters using JK Flip Flops. **Design of Synchronous Sequential circuits:** Model selection, State Transition Diagram.	**5**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Digital Principles and Design	Donald. D. Givone	1st	Tata McGraw Hill	2016
2.	Digital Principles and Applications	Donald P Leach, Albert Paul Malvino, Goutam Saha	8th	Tata McGraw Hill	2018

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Illustrative Approach to Logic Design	R D Sudhaker Samuel	1st	Sanguine-Pearson	2010
2	Digital Design: With an Introduction to the Verilog HDL and System Verilog, Digital Design :With an Introduction to Verilog HDL and System Verilog	M Morris Mano, Michael D. Ciletti	6th	Pearson	2018
3	Analog and Digital Electronics	Charles H Roth, Larry L Kinney	1st	Cengage Learning	2019

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction to Logic Design	Alan B. Marcovitz	3rd	McGraw Hill	2010	https://dl.icdst.org/pdfs/files3/fcba7ca1c74a45934f11dbb72e6678b9.pdf
2	Foundation of Digital Electronics and Logic Design	Subir Kumar Sarkar, Asish Kumar De, Souvik Sarkar	1st	Pan Stanford	2014	https://72arkarcy.wordpress.com/wp-content/uploads/2016/09/foundation-of-digital-electronics-and-logic-design-2014.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1.	Hardware Modeling using Verilog	NPTEL	2019	https://onlinecourses.nptel.ac.in/noc19_cs72/preview
2.	Digital Circuits	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc22_ee110/preview

Course Outcomes (COs):

CO1	Apply principles of logic design to construct digital circuits.
CO2	Analyse the functionalities of digital circuits.
CO3	Design combinational and sequential logic circuit from functional description.
CO4	Demonstrate the functionalities of logic circuits using simulation software.

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												
CO4			2		2			1	1	1					

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 (Simulation):

Students are supposed to show the implementation of any given digital circuit using iVerilog or any other open-source simulation software. The problem statement to be framed for which the student has to come up with design first using pen and paper and then implement using iVerilog or any other open-source simulation software and demonstrate the same. A report has to be submitted in the prescribed format. Also, a demonstration of simulated scenarios along with a report has to be submitted.

Note: Demonstration of iVerilog software with working codes will be shown to students.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only
2	3rd and 4th	Demonstration of iVerilog software with sample working codes will be shown to students.
3	5th , 6th and 7th	Implementation of the given assignment problems.
4	8th and 9th	Demonstration of the simulated scenarios in the chosen simulator.
5	10th and 11th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Design of the solution for the given problem	(5-4) The solution design is perfectly matching to the given problem statement.	(3-2) The solution design is almost matching to the given problem statement	(1-0) The solution design is partially matching to the given problem statement.	__/5
Implementation of the logic circuit using iVerilog or any other related software	(6-5) Implementation of the logic circuit has been done accurately with the required waveforms demonstration.	(4-3) Implementation of the logic circuit has been done appropriately.	(2-0) Implementation of the logic circuit has been with partial working features.	__/6
Testing for various inputs	(4-3) The implemented algorithm works for any given valid input.	(2) The implemented algorithm works for almost all valid inputs.	(1-0) The implemented algorithm works for any some valid inputs.	__/4
Report	(2) Clear and Effective writing and adherence to appropriate style guidelines	(1) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(0.5-0) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/2

Oral communication (presentation)	(2) Clear and effective communication with good background of the subject knowledge	(1.5) Communication is clear	(1-0) Unclear communication	__/2
Participation in Discussions	(1) Provided many good ideas inspired others clearly communicated ideas, needs, and feelings.	(0.75) Participated in discussions, on some occasions, made suggestions.	(0.5-0) Listened mainly, Rarely spoke up, and ideas were off the mark.	___/1
Total				**__/20**

AAT Plan (Assignment):

1. Assignments to be given to students at the end of each unit where students solve problems related to each unit. All faculty handling the course need to discuss and come up with problems to be given to students.
2. Total: 5 assignments , Marks :5*4=20 marks
3. Each assignment carries 5 marks and the sum of the best 4 out of 5 assignments to be taken for consideration.
4. Timely submission of the assignment is must and it must be handwritten only. The criteria for evaluation depends on the correctness and timely submission. Plagiarism also to be taken care of.
5. The AAT marks will be the sum of Simulation and Assignment.
    - Simulation - 20 Marks
    - Assignment - 20 Marks

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

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-2	Mandatory	One Question to be asked for 20 Marks
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	60%
Create / Evaluate	15%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

(Autonomous College under VTU Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Database Management Systems**		
Course Code:	**23CS3PCDBM**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction to Databases**: Introduction, An Example, Characteristics of Database approach, Advantages of using DBMS approach, When not to use a DBMS. **Database System Concepts and Architecture:** Data models, Schemas and instances, Three schema architecture. **SQL**: SQL Data Definition and Data Types specifying basic constraints in SQL, Schema Change Statement in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL, More complex SQL Queries, Views (Virtual Tables) in SQL, Triggers and Stored Procedures.	**8**
2	**Data Modelling using the Entity-Relationship(ER) model**: Using High-Level conceptual Data Models for Database Design, A sample Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity types, Refining the ER Design, ER Diagrams, Relationship Types of Degree Higher than two, Relational Database Design using ER-to-Relational Mapping. **Relational Algebra**: Unary Relational Operations, SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Aggregate functions and Grouping	**8**
3	**Database Design Theory and Normalization:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multi-valued Dependencies and a Fourth Normal Form, Join Dependencies, Fifth Normal Form.	**8**
4	**Transaction Processing, Concurrency Control:** Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control. ARIES Recovery Algorithm	**8**
5	**NoSQL**: An overview of NoSQL, Characteristics of NoSQL, NoSQL storage types, Advantages and Drawbacks of NoSQL, Case Study: Application definition, Requirement Analysis, Implementation using MongoDB, Database Queries, Writing Queries. **Vector database:** Introduction, Vector Index, Working of Vector database.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Database Systems	Ramez Elmasri, Shamkant B Navathe	6th	Pearson	2017
2.	Getting Started with NoSQL	Gaurav Vaish	1st	Packt	2013
3.	Vector Database	Roie Schwaber-Cohen	1st	Pinecone	2023

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Database Management Systems	Ramakrishnan, Gehrke	3rd	McGraw Hill	2014
2.	Database Systems: The Complete Book	Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom	2nd	Pearson Education	2001
3.	Database System Concepts	Abraham Silberschatz, Henry F. Korth, S. Sudarshan	6th	Tata McGraw-Hill	2010

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	An Introduction to Relational Database Theory	Hugh Darwen	1st	Ventus Publishing	2012	https://dvikan.no/ntnu-studentserver/kompendier/an-introduction-to-relational-database-theory.pdf

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1.	Data Base Management System	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Course Outcomes (COs):

CO1	Apply the concepts of database management system for various applications.
CO2	Analyse database concepts for a given problem.
CO3	Design SQL queries and conceptual data models for database applications.
CO4	Demonstrate SQL commands to create, manipulate and query data in a database.

CO-PO-PSO Mapping:

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

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:

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

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

RUBRICS / MARKS EVALUATION (50) – These 50 marks will be converted to 10 marks

TITLE	MARKS
ER DIAGRAM	15
SCHEMA DIAGRAM	5
IMPLEMENTATION	15
SQL QUERY	15

Instructions for the lab test:

1. Test will be conducted in two days. First-day students will be given the questions to write ER diagram, schema diagram and start the implementation in the Lab. (**Group Task - 4 members**)
2. On the second day, students will be given an SQL query to write the answer and demonstrate the same on the implemented database. (**Individual task**)

Final CIE marks (50) will be allotted as follows:
Regular lab (10 marks) + Record (5 marks) + Test (10 marks)

Writing SQL Queries for the following database systems:

Experiment #	Name of Experiment
1	Insurance Database
2	More Queries Insurance Database
3	Bank Database
4	More Queries on Bank Database
5	Employee Database
6	More Queries on Employee Database
7	Supplier Database
8	No SQL - Student Database
9	No SQL - Customer Database
10	No SQL - Restaurant Database

PROGRAM 1: INSURANCE DATABASE

Consider the Insurance database given below.
PERSON (driver_id: String, name: String, address: String)
CAR (reg_num: String, model: String, year: int)
ACCIDENT (report_num: int, accident_date: date, location: String)
OWNS (driver_id: String, reg_num: String)
PARTICIPATED (driver_id: String,reg_num: String, report_num: int, damage_amount: int)

i. Create the above tables by properly specifying the primary keys and the foreign keys.
ii. Enter at least five tuples for each relation

iii. Display Accident date and location
iv. Update the damage amount to 25000 for the car with a specific reg_num (example 'K A053408') for which the accident report number was 12.
v. Add a new accident to the database.
vi. Display Accident date and location
vii. Display driver id who did accident with damage amount greater than or equal to Rs.25000

PROGRAM 2. More Queries on Insurance Database

PERSON (driver_id: String, name: String, address: String)
CAR (reg_num: String, model: String, year: int)
ACCIDENT (report_num: int, accident_date: date, location: String)
OWNS (driver_id: String, reg_num: String)
PARTICIPATED (driver_id: String,reg_num: String, report_num: int, damage_amount: int)
Create the above tables by properly specifying the primary keys and the foreign keys as done in "Program-1"week's lab and Enter at least five tuples for each relation.
i. Display the entire CAR relation in the ascending order of manufacturing year.
ii. Find the number of accidents in which cars belonging to a specific model (example 'Lancer') were involved.
iii. Find the total number of people who owned cars that involved in accidents in 2008.
iv. List the entire participated relation in the Descending Order of Damage Amount.
v. Find the Average Damage Amount.
vi. Delete the tuple whose Damage Amount is below the Average Damage Amount
vii. List the name of drivers whose Damage is Greater than the Average Damage Amount.
viii. Find Maximum Damage Amount.

PROGRAM 3: Bank Database

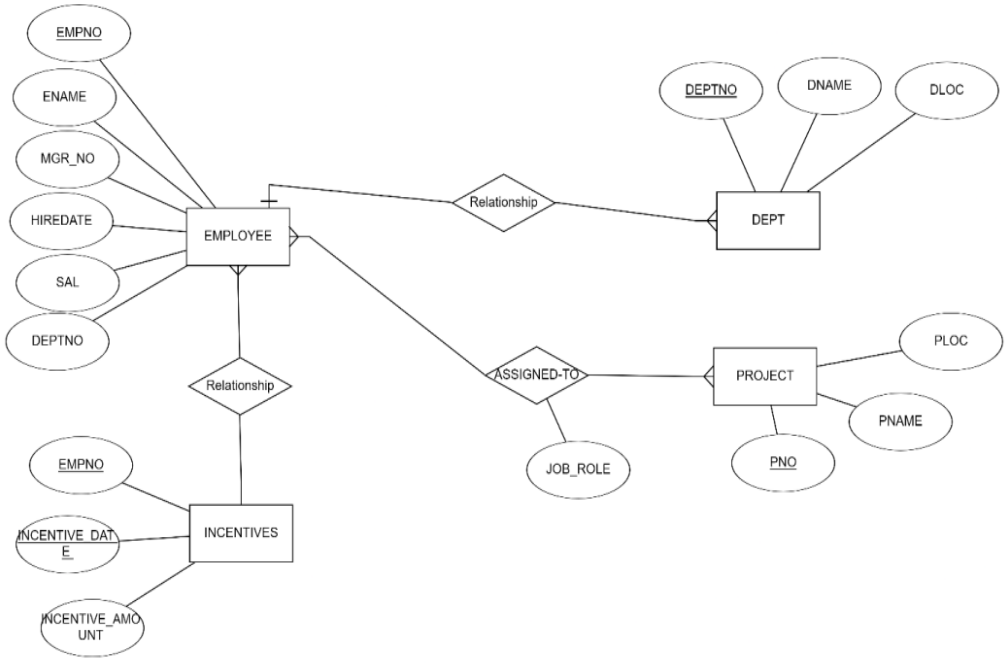
Branch (branch-name: String, branch-city: String, assets: real)
BankAccount(accno: int, branch-name: String, balance: real)
BankCustomer (customer-name: String, customer-street: String,
customer-city: String)
Depositer(customer-name: String, accno: int)
LOAN (loan-number: int, branch-name: String, amount: real)
i. Create the above tables by properly specifying the primary keys and the foreign keys.
ii. Enter at least five tuples for each relation.
iii. Display the branch name and assets from all branches in lakhs of rupees and rename the assets column to 'assets in lakhs'.
iv. Find all the customers who have at least two accounts at the *same* branch (ex. SBI_ResidencyRoad).
v. Create a view which gives each branch the sum of the amount of all the loans at the branch.

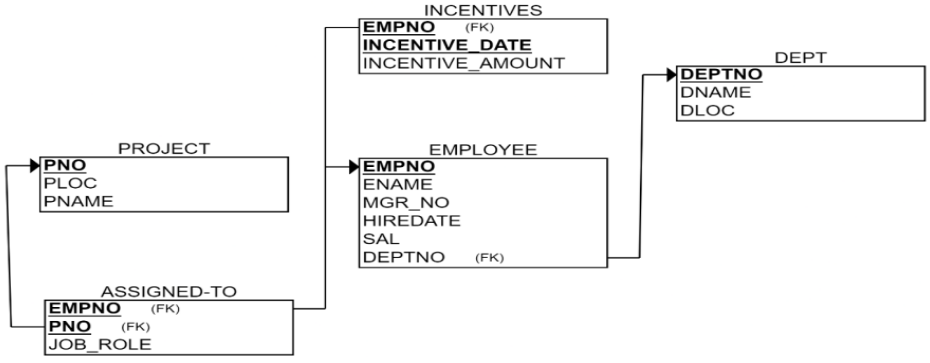
PROGRAM 4: More Queries on Bank Database

Branch (branch-name: String, branch-city: String, assets: real)
BankAccount(accno: int, branch-name: String, balance: real)
BankCustomer (customer-name: String, customer-street: String, customer-city: String)
Depositer(customer-name: String, accno: int)
LOAN (loan-number: int, branch-name: String, amount: real)

i. Find all the customers who have an account at all the branches located in a specific city (Ex. Delhi).
ii. Find all customers who have a loan at the bank but do not have an account.
iii. Find all customers who have both an account and a loan at the Bangalore branch
iv. Find the names of all branches that have greater assets than all branches located in Bangalore.
v. Demonstrate how you delete all account tuples at every branch located in a specific city (Ex. Bombay).
vi. Update the Balance of all accounts by 5%

PROGRAM 5: Employee Database



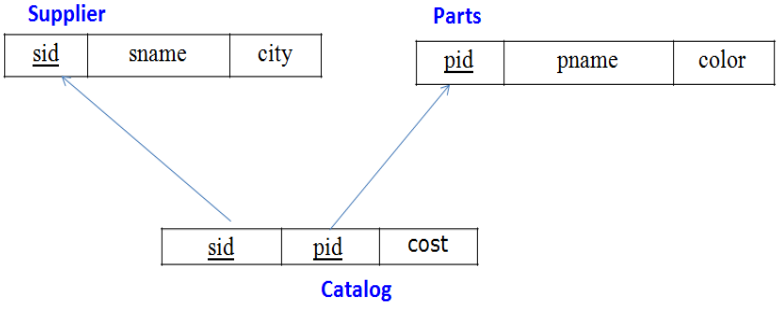


i. Using Scheme diagram, create tables by properly specifying the primary keys and the foreign keys.
ii. Enter greater than five tuples for each table.
iii. Retrieve the employee numbers of all employees who work on project located in Bengaluru, Hyderabad, or Mysuru
iv. Get Employee ID's of those employees who didn't receive incentives
v. Write a SQL query to find the employees name, number, dept, job_role, department location and project location who are working for a project location same as his/her department location.

PROGRAM 6: More Queries on Employee Database

i. Using Scheme diagram (under Program-5), Create tables by properly specifying the primary keys and the foreign keys.
ii. Enter greater than five tuples for each table.
iii. List the name of the managers with the maximum employees
iv. Display those managers name whose salary is more than average salary of his employee.
v. Find the name of the second top level managers of each department.
vi. Find the employee details who got second maximum incentive in January 2019.
vii. Display those employees who are working in the same department where his manager is working.

PROGRAM 7: Supplier Database



i. Using Scheme diagram, Create tables by properly specifying the primary keys and the foreign keys.
ii. Insert appropriate records in each table.
iii. Find the pnames of parts for which there is some supplier.
iv. Find the snames of suppliers who supply every part.
v. Find the snames of suppliers who supply every red part.
vi. Find the pnames of parts supplied by Acme Widget Suppliers and by no one else.
vii. Find the sids of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part).
viii. For each part, find the sname of the supplier who charges the most for that part.

PROGRAM 8: NoSQL Student Database

Perform the following DB operations using MongoDB.

i. Create a database "Student" with the following attributesRollno, Age, ContactNo, Email-Id.
ii. Insert appropriate values
iii. Write query to update Email-Id of a student with rollno 10.
iv. Replace the student name from "ABC" to "FEM" of rollno 11.
v. Export the created table into local file system
vi. Drop the table.
vii. Import a given csv dataset from local file system into mongodb collection.

PROGRAM 9: NoSQL Customer Database

Perform the following DB operations using MongoDB.

i. Create a collection by name Customers with the following attributes.
Cust_id, Acc_Bal, Acc_Type
ii. Insert at least 5 values into the table.
iii. Write a query to display those records whose total account balance is greater than 1200 of account type 'Z' for each customer_id.
iv. Determine Minimum and Maximum account balance for each customer_id.
v. Export the created collection into local file system.
vi. Drop the table.
vii. Import a given csv dataset from local file system into mongodb collection.

PROGRAM 10: NoSQL Restaurant Database

Perform the following DB operations using MongoDB.

i. Write NoSQL Queries on "Restaurant" collection.
ii. Write a MongoDB query to display all the documents in the collection restaurants.
iii. Write a MongoDB query to arrange the name of the restaurants in descending along with all the columns.
iv. Write a MongoDB query to find the restaurant Id, name, town and cuisine for those restaurants which achieved a score which is not more than 10.
v. Write a MongoDB query to find the average score for each restaurant.
vi. Write a MongoDB query to find the name and address of the restaurants that have a zipcode that starts with '10'.

SEE Exam Question Paper Format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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:	**3**		
Course Title:	**Data Structures**		
Course Code:	**23CS3PCDST**	**Total contact hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction**: Data and Information, Data Structure, Classification of Data Structures, Data structure versus File Organization, Operations on Data Structure. Introduction to Structures, pointers and Dynamic Memory allocation. **Stacks**-Operations, array representations of stacks, Stack applications -Infix to postfix conversion, Postfix expression evaluation, function call tracing, recursion.	8
2	**Queues**: Introduction, Basic concept, queue operations, circular queue, priority queues, double ended queues. **Linked List**: Singly linked list implementation, insertion, deletion and searching operations on linear list.	8
3	**Linked List**: Circularly linked lists- insertion, deletion and searching Operations for Circularly linked lists, doubly linked list implementation, insertion, deletion and searching operations, applications of linked lists – Stack and queue implementation, maintaining directory of names, Manipulation of polynomials (addition), representing sparse matrices.	8
4	**Trees**: Definitions, tree representation, properties of trees, Binary tree, Binary tree representation, Binary tree properties, Binary tree traversals, Binary tree implementation, Binary Search Tree operations and its implementation, Applications of trees. **Graph**: Introduction, Trees versus Graph, Graph Traversals: Breadth-First Search (BFS) – Examples and programs, Depth-First Search (DFS) – Examples and programs.	8
5	**Hashing Techniques**: Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Data Structures in C	Horowitz Sahni, Anderson Freed	2nd	Universities Press	2008
2	Data Structures using C	Reema Thareja	2nd	Oxford University Press	2014

3	A Simplified Approach to Data Structures	Lalit Goyal, Vishal Goyal, Pawan Kumar	1st	SPD	2014

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Data Structures using C	Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein	5th	Pearson Education	2007
2	An Introduction to Data Structure with Applications	Jean - Paul Tremblay, Paul Sorenson	2nd	Tata MacGraw Hill	2007

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Data Structures using C	Reema Thareja	2nd	Oxford University Press	2014	http://www.ir.juit.ac.in:8080/jspui/bitstream/123456789/5374/1/Data%20structures%20using%20C%2C%202nd%20Ed.%20by%20Thareja%2C%20Reema%20%282014%29.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Data Structures	Coursera	2022	https://www.coursera.org/learn/data-structures
2	Data Structures and Algorithms	NPTEL	2022	https://nptel.ac.in/courses/106102064/

Course Outcomes (COs):

CO1	Apply the concept of linear and nonlinear data structures
CO2	Analyse data structure operations for a given problem
CO3	Design and develop solutions using the operations of linear and nonlinear data structure for a given specification
CO4	Conduct practical experiments for demonstrating the operations of different data structures.

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												3
CO4			3	2	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

Laboratory Plan:

1. Students should write the program (pseudocode) for that week to be executed in the lab at the beginning of each lab and get it corrected by the batch-in-charge faculty and then start with the program execution.
2. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.
3. Continuous Internal Evaluation for each lab is for 10 marks which includes execution of the program in the allotted lab time and showing the output. If Leetcode program is present for a particular lab, student needs to complete that also within the allotted lab slot only and show the output. Observation book needs to be corrected on the same day itself.

   Note: Wherever LeetCode program is present, the program to be executed will be shared during the particular lab week.

   Note: Student completes the program on the day within the lab timings and shows the output for any given input case: 10 marks

   Student completes the program on the day within the lab timings and shows the output for only
   some input cases: 8 marks

   Student completes the program on the day and shows the output for any given input case: 6 marks

   Student completes the program on the day within one week and shows the output for any given input case: 4 marks
   Submission any later: 0 marks

4. One Lab Test will be conducted for all the 10 programs. Lab Test will comprise programs which are completely different from the existing lab list of programs.

5. Marks split up for Lab:
Continuous Internal Evaluation: **100 marks → reduced to 10 marks**
Lab Test: **60 marks → reduced to 15 marks** (Writeup- 15 marks, Execution- 25 marks, Modification asked in the program for execution – 10 marks, Viva- 10 marks)

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	1	10	Write a program to simulate the working of stack using an array with the following: a) Push b) Pop c) Display The program should print appropriate messages for stack overflow, stack underflow
2	1	5	WAP to convert a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)
		5	Demonstration of account creation on LeetCode platform Program - Leetcode platform
3	2	5	a) WAP to simulate the working of a queue of integers using an array. Provide the following operations: Insert, Delete, Display The program should print appropriate messages for queue empty and queue overflow conditions
		5	b) WAP to simulate the working of a circular queue of integers using an array. Provide the following operations: Insert, Delete & Display The program should print appropriate messages for queue empty and queue overflow conditions

4	2	5	WAP to Implement Singly Linked List with following operations a) Create a linked list. b) Insertion of a node at first position, at any position and at end of list. Display the contents of the linked list.
		5	Program - Leetcode platform
5	3	5	WAP to Implement Singly Linked List with following operations a) Create a linked list. b) Deletion of first element, specified element and last element in the list. c) Display the contents of the linked list.
		5	Program - Leetcode platform
6	3	5	a) WAP to Implement Single Link List with following operations: Sort the linked list, Reverse the linked list, Concatenation of two linked lists.
		5	b) WAP to Implement Single Link List to simulate Stack & Queue Operations.
7	3	5	WAP to Implement doubly link list with primitive operations a) Create a doubly linked list. b) Insert a new node to the left of the node. c) Delete the node based on a specific value d) Display the contents of the list
		5	Program - Leetcode platform
8	4	5	Write a program a) To construct a binary Search tree. b) To traverse the tree using all the methods i.e., in-order, preorder and post order c) To display the elements in the tree.
		5	Program - Leetcode platform

9	4	5	a) Write a program to traverse a graph using BFS method.
		5	b) Write a program to check whether given graph is connected or not using DFS method.
10	5	10	Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are integers. Design and develop a Program in C that uses Hash function H: K -> L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

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	10%
Apply / Analyze	50%
Create / Evaluate	40%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Unix Shell Programming**		
Course Code:	**23CS3PCUSP**	**Total Contact Hours:**	**25**
L-T-P:	**0-1-0**	**Total Credits:**	**1**

Unit No.	Topics	Hours
1	**Overview of UNIX**: Introduction to UNIX Operating System, Architecture, Kernel and Shell, Features, Internal and External Commands, Basic Commands: cal, date, echo, bc, script, passwd, PATH, who, uname, pwd, cd, mkdir, rmdir. Command Structure, Shell Script and Shell Programming, UNIX Server	**3**
2	**File System:** Introduction to File system, File creations and its related commands cat, cp, rm, mv, more, file, ls, wc, pg, cmp, comm, diff. Zipping & unzipping files, gzip, tar, zip. File Permissions with chgrp & chmod	**3**
3	**Managing file links**: hard links; symbolic links; Process Control: Viewing a Process, Command to display Process, Process Attributes, Process States, Process Fields, ps Commands options, Handling Jobs, Foreground & Background Jobs	**3**
4	**Shell Programming:** Shell as an interpreter, shell variables, environment variables , Keywords, Assignment Statements, read , echo ,Shell scripts and execution methods, exit Status of a Command	**3**
5	Branching Control Structures, Loop-Control Structure, Continue and break Statements, Expressions, Command Substitution, Command Line Arguments and Functions.	**3**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	The UNIX Programming Environment	Brain W Kernighan, Rob Pike	1st	Pearson Education India	2015
2	UNIX and Shell Programming	Behrouz A. Forouzan, Richard F. Gilberg	1st	Cengage Learning India	2003

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Unix Concepts and Applications	Sumitabha Das	4th	TMH	2006
2	Introduction to Unix & Shell Programming	Venkatesh Murthy	1st	Pearson Education	2010

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Beginning Shell Scripting	Eric Foster-Johnson, John C. Welch, Micah Anderson	1st	Wiley Publishing, Inc.	2005	https://fisnikd.wordpress.com/wp-content/uploads/2009/11/beginning-shell-scripting.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Unix and Shell Programming for Beginners	Udemy	2022	https://www.udemy.com/course/shellprogramming
2	Hands-on Introduction to Linux Commands and Shell Scripting	Coursera	2023	https://www.coursera.org/learn/hands-on-introduction-to-linux-commands-and-shell-scripting

Course Outcomes (COs):

CO1	Apply basic concepts of UNIX Architecture, File system and basic commands to Shell Programming.
CO2	Interpret Linux Commands and shell environments.
CO3	Develop scripts to automate the tasks for specific requirements.

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	1				2	2	1	1				

Assessment Plan for CIE:

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

Tutorial Plan:

Tutorial #	Unit #	Topic
1	1	• Basic architecture of UNIX (Kernel, Shell, Filesystem). • Introduction to the Shell and its types (Bash, Zsh, Ksh, etc.). • Role of the Shell in command execution.
2	1	Practice Basic Commands
3	1	Explore the multiuser environment by creating and managing user accounts.
4	1	Exercise on setting permissions for files and directories.
5	2	• Compare and contrast different shells • Customize the shell prompt and environment variables
6	2	Explore and modify the PATH environment variable.
7	3	• Write a shell script that utilizes multiple basic commands. • Practice using each command with different options.
8	3	• Perform file operations using various commands. • Modify file permissions and observe the effects.
9	4	• Develop scripts using loops and conditional statements • Write a script to automate a simple task
10	4	• Handling errors and exceptions in scripts. • Debug a sample script with errors.
11	5	Develop a script for automating system updates.
12	5	• Write a script using functions for modularity. • Process text files using awk, sed, and grep commands.

AAT Plan:

- The student should form a team of size 3 to 4 and select a project problem.
- Students are required to explore a real-world problem, and develop and demonstrate a shell Script with a user-friendly UI/UX.
- The student can select project based on shell scripting/System programming / Operating system concept simulation

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only
2	3rd	AAT topic selection by each group
3	4th	Presentation: Student team and topic introduction by each group
4	5th, 6th and 7th	Implementation of Shell Script for the selected topic.
5	8th, 9th and 10th	Demonstration of UI/UX using Zenith and Dialog.
6	11th and 12th	AAT Report Preparation

Rubrics used for Evaluation:

Criteria	Excellent	Proficient	Partially Proficient	Points
Problem Definition	(8 -7) Project is creative, original and well planned	(6-5) Project is moderately creative, original and planned	(4 -3) Project is not creative, neither original nor planned	__/8
Selection of Unix Commands and user interface	(7-5) The command selection for all modules is designed appropriately in accordance to the requirements and effective user interface	(4 -3) The commands are not straight forward usage for the modules in accordance to the requirements and simple interface	(2-1) The commands for the modules are designed inappropriately in accordance to the requirements and no interface.	__/7

Criteria	Excellent	Proficient	Partially Proficient	Points
Implementation and Testing	(10-8) Ideal implementation of modules for all set objectives and appropriate test cases	(7-5) Appropriate implementation of modules for most of the set objectives and limited test cases.	(4-3) Concern to implementation of modules for a few set objectives and test cases	__/10
Report	(5-4) Clear and Effective writing and adherence to appropriate style guidelines	(3-2) 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	__/5
Oral communication (presentation)	(5-4) Clear and effective communication	(3-2) Communication is clear	(1) Unclear communication	__/5
Participation in Discussions	(5-3) Provided many good ideas; inspired others; clearly communicated ideas, needs, and feelings.	(2) Participated in discussions; on some occasions, made suggestions.	(1) Listened mainly; Rarely spoke up, and ideas were off the mark.	__/5
Total				**__/40**

SEE Exam (for 50 Marks):

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

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Full Stack Web development**		
Course Code:	**22CS3AEFWD**	**Total Contact Hours:**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Guidelines:

- This course focuses on developing comprehensive skills in Full Stack Web Application Development. Students will learn to develop both front-end and back-end components of web applications, integrate with databases and external services, and apply best practices in web development.
- Under this project work, student should develop Advanced Web based Application using technologies such as PHP, Python, Node JS, React, Angular.
- Students can form a group with minimum of three and maximum of four.
- Teacher allotted for project work to students should teach full stack technologies like Node JS, React, etc., during Class/Lab hours as per the allotment. Teacher allotted for project work should guide the students in choosing the topic and towards carrying out project work and complete the evaluation of assigned students.

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Modern Full-Stack Development: Using Type Script, React, Node.js	Frank Zammetti	1st	Apress	2020
2	Beginning MERN Stack , Build and Deploy a Full Stack MongoDB, Express, React, Node.js App	Greg Lim	1st	Amazon Digital Services	2021

Tutorial Links:

1. https://www.springboard.com/resources/learning-paths/web-development-python-django/
2. https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javacript
3. https://www.boardinfinity.com/micro-learning/full-stack-development-course-with-certification
4. https://www.udemy.com/course/next-js-the-complete-developers-guide/
5. https://www.udemy.com/course/nextjs-build-full-stack-apps-with-nextjs-using-redux/

Course Outcomes (COs):

CO1	Apply full-stack web development technologies to solve real-world problems.
CO2	Design and develop user-centric web applications focused on social and environmental issues.
CO3	Integrate front-end and back-end components effectively with databases and external services.
CO4	Demonstrate teamwork and problem-solving skills in project development.

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
Quiz	---	---
Lab Component	**CIE through Reviews**	**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	Formation of groups. Note: Student groups of size 3 to 4	Introduction to Full Stack Technologies & Issue Identification	• Overview of full stack development tools and frameworks. • Overview of web development (HTML, CSS, JavaScript), • Introduction to full stack frameworks (MEAN, MERN), Identifying social/environmental issues for web solutions.

2	2nd	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Conceptualizing a Web Application	• Identifying problem and understanding social and environmental issues. • Brainstorming and planning a web application focused on a chosen social/environmental issue. • Tools for wireframing and prototyping (Figma, Sketch)
3	3rd	Design Layout of the Web Pages	Basic Front-end and Back-end Development	• Define layouts based on project scope and objectives. • Learning the basics of front-end (HTML, CSS, JavaScript) and back-end (Node.js, Python) development. • Front-end: HTML5, CSS3, JavaScript basics. • Back-end: Introduction to Node.js, Express.js, RESTful API development
4	4th, 5th and 6th	Front end and back-end implementation	Data Management and Integration	• Techniques for managing and integrating data in web applications. • Database technologies (MongoDB, SQL), Integrating databases with back-end (Mongoose for MongoDB), Basic CRUD operations.
5	7th, 8th and 9th	Design and Development of connecting among different web pages	Advanced Front-end & Back-end Technologies Project Development and Mid-term Review	• Delving into advanced front-end technologies (React, Angular) and back-end technologies (databases, server management). • Front-end: React.js/Angular for dynamic UI development. • Back-end: Advanced Node.js, Authentication (JWT, OAuth), Server-side rendering. • Development of the project with guidance and a mid-term review to assess progress.

6	10th	Presentation by each group	Integrating Feedback & Refining Applications	• Applying feedback from the mid-term review and refining the application for better performance and impact. • Implementing feedback, Optimization for performance, Security best practices (HTTPS, data validation), User testing and UX improvements.
7	11th	Complete Project Work Demonstration by each group	Final Project Presentations and Submissions	Students present their completed projects and submit their final work for assessment.
8	12th	Project Report Preparation		

Rubrics for Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Problem Identification & Relevance	(18-16) Clearly articulates a significant social/environmental issue with insightful, innovative solutions.	(15-10) Recognizes a pertinent issue and offers practical solutions.	(9-5) Identifies a basic issue with standard solutions.	(4-0) Fails to identify a relevant issue or solution.	__/18
Technical Implementation	(28-21) Exemplary implementation of full-stack technologies, showcasing efficiency, integrity, scalability, sustainability and technical excellence.	(20-11) Reliable and proficient technical performance and integrity meeting key objectives.	(10-5) Basic implementation incorporating essential features and functionalities.	(4-0) Inadequate or incomplete technical implementation.	__/28

User Experience & Interface	(20-15) Exceptional UI/UX design, prioritizing intuitiveness and user-friendliness, with a professional standard of execution.	(14-10) Competent UI design focused on usability and functionality.	(9-5) Basic UI design encompassing essential functions and user needs.	(4-0) Poor or non-functional user interface, lacking in user-centricity.	__/20
Group Participation	(12-9) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(8-6) Consistent participation and constructive collaboration within the group.	(5-3) Minimal but noticeable participation and occasional contributions.	(2-0) Lack of active participation and collaboration in the group.	__/12
Presentation	(10-8) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(7-6) Well-structured presentation with clear content and effective delivery.	(5-3) Basic presentation with some structure and varying delivery quality.	(2-0) Disorganized presentation lacking in coherence and adequate content.	__/10
Report & Documentation	(12-9) Comprehensive report covering all project aspects with meticulous documentation, including methodology, design, and future scope.	(8-6) Well-structured report with detailed coverage of project implementation.	(5-3) Basic report with limited content, covering essential project details.	(2-0) Poorly structured and incomplete report, lacking essential details.	__/12
Total					**_/100**

Note: The project will be evaluated 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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Technical Writing**		
Course Code:	**23CSAETEW**	**Total Contact Hours:**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Introduction:

- The students will explore the theory and practice of writing in a broad range of fields, such as the business, scientific, and industrial fields.
- Students will examine a variety of professional writing samples to gain an understanding of the skills needed to successfully communicate through professionally written e-mails, memos, business letters, and various types of reports and analyses.
- Students will learn to evaluate and respond to the ideas that they encounter within the selections. The course will aim to develop students' writing skills, essential for the production of professional documents.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Writing in the Technical Fields: A Practical Guide	Ewald, Thorsten	2nd	Oxford University Press	2017
2	Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals	Laplante, Phillip A	2nd	CRC Press	2019

Tutorial Links:

1. https://writingcenter.unc.edu/tips-and-tools/
2. https://owl.purdue.edu/owl/
3. https://pressbooks.bccampus.ca/technicalwriting/

Course Outcomes (COs):

CO1	Write personal and academic responses to written works using appropriate terminology
CO2	Apply reading skills to understand and evaluate and summarize various technical documents

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			3	3	3					

Assessment Plan for CIE:

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

Activity Plan:

Sl. No	Week	Activity
1	1st	Write at least four multi-paragraph, technical documents of at least 500 words.
2	2nd	Write at least two in-class documents.
3	3rd and 4rd	Writing exercises such as summaries, journals, reading responses, reading comprehension questions.
4	5th and 6th	Read, interpret, and analyse a wide variety of technical work.
5	7th, 8th and 9th	Conduct independent research and write a 7–10-page research report.
6	10th, 11th and 12th	Prepare documents that adhere to manuscript requirements and demonstrate effective proofreading and editing.

Rubrics for Evaluation:

Criteria	Excellent	Good	Fair	Poor	Points
Clarity & Organization	(25-20) Well-organized, with excellent flow and logical structure	(19-15) Ideas are generally clear and logical but may lack some depth or smooth transitions.	(14-10) Some clarity, but lacks coherence; ideas may be incomplete or poorly sequenced.	(9-1) Writing is unclear, lacks logical flow; key ideas are hard to follow or missing.	__/25

Technical Accuracy	(20-15) Completely accurate, with no errors; demonstrates excellent technical understanding	(14-10) Generally accurate, with minor errors or omissions; technical understanding is adequate.	(9-5) Some technical errors or misunderstandings; important details may be inaccurate.	(4-1) Contains significant errors in technical content or terminology; major concepts are misunderstood.	__/20
Language & Style	(15-10) Highly professional, precise, and appropriate language; excellent use of technical vocabulary; no grammar or spelling errors.	(9-6) Appropriate language with minor style inconsistencies; few grammars or spelling errors.	(5 -3) Language is somewhat appropriate but may be overly casual or informal; several grammars or spelling errors	(2-1) Uses inappropriate or unprofessional language; frequent grammar and spelling errors; lacks technical vocabulary	__/15
Document Design, Formatting and ethical integrity	(25-20) Exceptionally well-formatted with a professional appearance; document is visually appealing and easy to navigate.	(19-15) Generally well-formatted with minor inconsistencies; document is readable.	(14-10) Some formatting issues; headings, fonts, or spacing are inconsistent but still readable.	(9-1) Poorly formatted with inconsistent or inappropriate use of headings, fonts, or spacing; difficult to read.	__/25
Oral communication / Presentation	(15-10) Excellent Communication	(9-5) Communication is clear	(4-3) Unclear communication	(2-1) Unable to communicate	__/15
Total					**__/100**

Note: The project will be evaluated for 100 marks and reduced to 50 marks.

SEE Exam (50 Marks):

Work carried out by students will be evaluated by external examiner along with internal faculty.

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**3**		
Course Title:	**Assembly Language**		
Course Code:	**23CS3AEASL**	**Total Contact Hours:**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Guidelines:

- This course focuses on developing comprehensive skills in programming in assembly language, understanding how a computer works instead of developing large programs and learning the underlying principles for generating compact machine code.
- The process of learning assembly language involves writing non-trivial programs to perform specific low-level actions including arithmetic operations, function calls, using stack-dynamic local variables, and operating system interaction for activities such as input/output. Under this project work, student should develop Assembly language programs using 8086 Instruction Set.
- Students can form a group with minimum of two and maximum of four.
- Teacher allotted for project work to students should teach the basics of 8086 architecture and instruction set to the students.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Advanced Microprocessor and peripherals	A K Ray, K M Bhurchandi	3rd	Tata McGraw-Hill Education	2012
2	Advanced Microprocessors and IBM - PC Assembly Language Programming	Udaya Kumar, B. Uma Shankar	1st	McGraw Hill Education	2017

Tutorial Links:

1. https://www.coursera.org/learn/introduction-iot-boards
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/arduino-vs-raspberry-pi
3. https://www.shiksha.com/online-courses/free-iot-and-connected-devices-courses-certification-training-st563-tg949?regFlow=N

Course Outcomes (COs):

CO1	Apply knowledge of architecture, instruction set and assembly language programming of microprocessor to solve problems.
CO2	Ability to analyze the given problem and select appropriate interrupts
CO3	Design and develop programs using 8086 instruction set architecture

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	---	---
Quiz	---	---
Lab Component	**CIE through Reviews**	**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	Introduction to Assembly programming	Introducing 8086 Architecture	Covering all the Architectural details of the 8086 Microprocessor.
2	2nd	Introduction to basic instruction set Architecture	Instructions like data transfer instructions and Arithmetic instructions to be delivered	Writing basic programs using like data transfer instructions and Arithmetic instructions
3	3rd	Introduction of program control structures	Branch and loop instructions to be covered	Writing basic programs using Branch and loop instructions
4	4th	Introduction of String instructions	Formats of all string instructions to be delivered	Writing and analysing basic programs using strings

5	5th	Formation of groups and selection of problem	Set of problems to be shared with the students and provide them with various complex concepts of Assembly programming	Students are asked to come up with a problem and choose any one of the advanced concept to implement the project
6	6th and 7th	Advanced architectural concepts. Design of the problem selected	Stacks and procedures. Review of the design of the problem	Usage of stacks and procedures in their problem
7	8th and 9th	Introduction to interrupts and their usage. Implementation of the problem	Interrupts. Review of implementation of the problem	Usage of Interrupts
8	10th	Incorporating ISA and advanced concepts in design and development of the problem	Review of the implementation of the entire problem	Complete problem implementation

Rubrics for Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Understanding the architecture of the microprocessor and instruction set	(20-16) Clearly exhibits the knowledge of architecture of the microprocessor and instruction set	(15-10) Exhibits the knowledge of architecture of the microprocessor and instruction set	(9-5) Partially able to Understanding the architecture of the microprocessor and instruction set	(4-0) Fails to Understanding the architecture of the microprocessor and instruction set	__/20
Apply and analyse the ISA to solve basic problems	(20-16) Exemplary knowledge in applying and analysis of ISA to solve the problems	(15-10) Good knowledge in applying and analysis of ISA to solve the problems	(9-5) Moderate knowledge in applying and analysis of ISA to solve the problems .	(4-0) Inadequate knowledge in applying and analysis of ISA to solve the problems	__/20
Develop the solution to the problem using architectural concepts and ISA	(20-16) Exceptional good in developing a solution using assembly language	(15-10) Competent enough in developing a solution using assembly language	(9-5) Moderately develops a solution using assembly language	(4-0) Poor in developing a solution using assembly language	__/20

Group Participation	(10-9) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(8-6) Consistent participation and constructive collaboration within the group.	(5-3) Minimal but noticeable participation and occasional contributions.	(2-0) Lack of active participation and collaboration in the group.	__/10
Presentation	(10-9) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(8-6) Well-structured presentation with clear content and effective delivery.	(5-3) Basic presentation with some structure and varying delivery quality.	(2-0) Disorganized presentation lacking in coherence and adequate content.	__/10
Report & Documentation	(20-16) Comprehensive report covering all project aspects with meticulous documentation	(15-10) Well-structured report with detailed coverage of project implementation	(9-5) Basic report with limited content, covering essential project details	(4-0) Poorly structured and incomplete report, lacking essential details	__/20
Total					**__/100**

Note: The project will be evaluated 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 an Internal faculty.

BMS COLLEGE OF ENGINEERING, BANGALORE-19
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

4th Semester

BMS COLLEGE OF ENGINEERING, BANGALORE-19

(Autonomous College under VTU Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Linear Algebra**		
Course Code:	**23MA4BSLAO**	**Total Contact Hours:**	**40**
L-T-P	**2-1-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**CONTINUOUS OPTIMIZATION – 1** Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent/ascent and NR method.	7
2	**CONTINUOUS OPTIMIZATION-2** Sequential search 3-point search and Fibonacci search. Constrained Optimization, Method of Lagrange multipliers, duality, KKT optimality conditions.	7
3	**INNER PRODUCT SPACES** Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt orthogonalization process, QR-factorization, least squares problem and least square error. Curve fitting – Principle of least squares, fitting a straight line and fitting a parabola.	7
4	**EIGENVALUES AND EIGENVECTORS** Introduction, Polynomials of Matrices, Cayley-Hamilton Theorem, eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.	7
5	**MATRIX DECOMPOSITION AND THEIR APPLICATIONS** Diagonalization, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, signature, index, Singular value decomposition, Dimensional reduction – PCA.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Linear Algebra and its applications	David C. Lay, Steven R. Lay, Judi J Mc. Donald	6th	Pearson Education	2021
2	Linear Algebra and its Applications	Gilbert Strang	4th	Brooks Cole	2005
3	Linear Algebra: An Introduction	Richard Bronson & Gabriel B. Costa	2nd	Academic press	

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Schaum's outline series - Theory and problems of linear algebra	Seymour Lipschutz, Marc Lipson	6th	McGraw-Hill Education	2017
2	Linear Algebra and Optimization for Machine Learning	Charu C. Aggarwal		Springer	2020
3	Linear Algebra	Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence	5th	Pearson	2019
4	Mathematics for Machine learning	Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong		Cambridge University Press	2020

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/linear-algebra-machine-learning
2. https://nptel.ac.in/syllabus/111106051/

Course Outcomes (CO's):

CO1	Apply the concepts of linear algebra in Computer and Allied Engineering Sciences.
CO2	Demonstrate the applications of computer science and Allied Engineering Science using modern ICT tools.

CO-PO-PSO mapping:

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

Assessment Tool Plan:

Tool	Remarks	Marks
Quiz	10	5
AAT	10	5
Test 1	40	20
Test 2	40	20
Total		**50**

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 2 and 5 and two questions each from Units 3 and 4.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Cryptography**		
Course Code:	**23CS4ESCRP**	**Total Contact Hours:**	**40**
L-T-P	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Security Goals, Cryptographic Attacks. **Mathematics of Cryptography:** Integer Arithmetic, Modular Arithmetic, Linear Congruence. **Traditional symmetric-Key Ciphers:** Introduction, Substitution Ciphers, Transposition Ciphers. **Mathematics of Symmetric-key cryptography:** Algebraic Structures, GF (2^n) Fields.	8
2	**Introduction to Modern Symmetric Key Ciphers:** Modern Block Ciphers, Modern Stream Ciphers. **Data Encryption Standard (DES):** Introduction, DES Structure, DES Analysis, Security of DES, Multiple DES. **Advanced Encryption Standard (AES):** Introduction, Transformations, Key Expansion, AES Ciphers, analysis of AES.	8
3	**Encipherment using Modern Symmetric-Key Ciphers:** Use of Modern Block Ciphers, Use of Stream Ciphers. **Mathematics of Asymmetric-Key Cryptography:** Primes, Primality Testing, Chinese Remainder Theorem, Quadratic Congruence, Exponentiation and Logarithm.	8
4	**Asymmetric -Key Cryptography:** Introduction, RSA cryptosystem, ElGamal Cryptosystem, Elliptic Curve cryptosystems. Cryptographic hash functions, SHA-512.	8
5	**Message Integrity and Message Authentication:** Message authentication, Digital Signature, RSA digital signature. **Key Management:** KERBEROS, Diffie-Hellman Key Agreement, X.509	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography and Network Security	Behrouz A. Forouzan, Debdeep Mukhopadhyay	2nd	Tata McGraw Hill	2013

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography: Theory and Practice	Stinson. D.	3rd	Chapman & Hall/CRC	2012
2	Cryptography and Network Security	Atul Kahate	1st	Tata McGraw-Hill	2003
3	Cryptography and Network Security Principles and practice	W. Stallings	5th	Pearson Education Asia	2013

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Cryptography and Network Security: Principles and Practice	William Stallings	3rd	Pearson Education	2007	http://williamstallings.com/Crypto3e.html
2	Handbook of Applied Cryptography	Menez, Van Oorschot, Vanstone	1st	CRC Press	2001	http://www.cacr.math.uwaterloo.ca/hac/

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Cryptography and Network Security	NPTEL	2017	http://nptel.ac.in/courses/106105031/
2	Cryptography I	Coursera	2019	https://www.coursera.org/course/crypto

Course Outcomes (COs):

CO1	Apply cryptographic techniques to ensure data confidentiality, integrity, and authentication
CO2	Analyze various symmetric and asymmetric cryptosystems and types of attacks on these cryptosystems
CO3	Demonstrate cryptographic encryption and decryption techniques

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

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

AAT Plan:

Students are supposed to develop a Cryptographic algorithm/Digital Signature (using C/C++ preferably) without using libraries or built-in functions. Code demonstration along with a report has to be submitted.

Example: Implement of RSA Digital Signature, Elgamal Digital Signature, Diffie Hellman Signature, Modified RSA algorithm for practical purpose, Hybrid encryption schemes.

Sl. No	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 2 members.
2	2nd and 3rd	AAT topic selection by each group
3	4th	Presentation: Student team and topic introduction by each group
4	5th	Design the workflow along with Front-end Design
5	6th and 7th	Presentation on Front-end Design of the application
6	8th and 9th	Design and Development of the actual algorithm and testing it for various test case
7	10th	Design and Development of the actual algorithm and testing it for various test case
8	11th	Complete code demonstration
9	12th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
User Interface / Front End Design or Tool usage.	(4) The designed application has an exceptional design, attractive and usable interface. It is easy to locate all important elements.	(3-2) The designed application has an attractive design and usable interface. It is easy to locate all important elements. Elements.	(1-0) The designed application has a usable design interface, but may appear busy or boring. It is easy to locate most of the important.	__/4
Algorithm OR Implementation done in the Tool	(12-9) Implementation of the algorithm has been done accurately without the usageof any library functions.	(8-5) Implementation of the algorithm has been done appropriately without the usage of any library functions.	(4-0) Implementation of thealgorithm has been done with usage of few library functions.	__/12
Implementation	(8-7) 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.	__/ 8
Testing for various cases	(4) The implemented algorithm works for any given valid input.	(3-2) The implemented algorithm works for almost all valid inputs.	(1-0) The implemented algorithm works for any some valid inputs.	___/4
Application/Relevance	(4) The designed algorithm has several applications andis relevant in thearea of cryptography.	(3-2) The designed algorithm has few applications and is relevant in the area ofcryptography.	(1-0) The designed algorithm has few applications and is notvery relevant in the area of cryptography.	__/4

Report	(4) Clear and Effective writingand adherence to appropriate style guidelines	(3-2) Writing that is clear and effective for the most part and minor errors in adherence toappropriate style guidelines	(1-0) Unclear and ineffective writing andmultiple errors in adherence to appropriate style guidelines	__/4
Oral communication (presentation)	(4) Clear and effective communication	(3-2) Communication is clear	(1-0) Unclear communication	__/4
Total				**__/40**

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

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Theoretical Foundations of Computations**		
Course Code:	**23CS4PCTFC**	**Total Contact Hours:**	**40**
L-T-P:	**2-1-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Finite Automata:** Central Concepts of Automata Theory, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Finite Automata with Epsilon Transition, An Application Text Search.	5
2	**Regular Expressions and Languages:** Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata	5
3	**Context Free Grammars and Languages Parse Trees:** Context Free Grammars, Parse trees, Applications of Context Free Grammars, Ambiguity in Grammars and Languages, Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Epsilon Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibach Normal form	5
4	**Pushdown Automata:** Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata, The Pumping Lemma for Context Free Languages, Closure Properties of Context Free Languages	5
5	**Introduction to Turing Machine:** Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers, Definition of Post's Correspondence Problem, A Language That Is Not Recursively Enumerable, An Undecidable Problem That is RE, Other Undecidable Problems	5

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Automata Theory, Languages and Computation	John E. Hop croft, Rajeev Motwani, Jeffrey D. Ullman	3rd	Pearson	2007

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Languages and Automata Theory	John C Martin	3rd	Tata McGraw-Hill	2007
2	An Introduction to formal Languages and Automata	Peter Linz	5th	Narosa publishing house	2012

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction to Theory of Computation	Anil Maheshwari, Michiel Smid	1st	Carleton University	2019	https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Automata Theory	Edx	2022	https://www.edx.org/course/automata-theory
2	Introduction to Automata, Languages and Computation	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc21_cs19/preview
3	Automata Theory	Stanford University	2022	https://online.stanford.edu/courses/soe-ycsautomata-automata-theory

Course Outcomes (COs):

CO1	Apply the knowledge of Automata Theory, Grammars & Regular Expressions for the given requirement of the formal language.
CO2	Analyse the given Automata to identify the formal language it represents.
CO3	Design Automata and Grammar for pattern recognition and syntax checking of the given formal language.

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

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

Tutorial Plan:

Tutorial #	Unit #	Topic
1	1	Problems on DFA
2	1	Problems on NFA
3	1	Problems on conversion of NFA to DFA
4	1	Real-life examples for DFA and NFA Design a Vending Machines, Video Games, Traffic lights
5	2	Problems on regular expressions
6	2	Problems on regular expressions
7	3	Problems on Grammar and Minimization
8	3	Problems on CFG
9	4	Problems on PDA
10	4	Problems on conversion of CGF to PDA and vice versa
11	5	Problems on Turing machine
12	5	Problems on Turing machine

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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	20%
Apply / Analyze	60%
Create / Evaluate	20%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Operating Systems**		
Course Code:	**23CS4PCOPS**	**Total contact hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction**: Computer-System Architecture, Operating System Structure, Operating system operations. **System Structures**: Operating system services, User and Operating system interface, System Calls, Types of System calls, System programs, Operating System Structure **Process Concept**: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.	8
2	**Multithreaded Programming**: Overview, Multi-core Programming, Multithreading Models, Implicit Threading, Threading Issues. **Process Scheduling**: Basic concepts, Scheduling Criteria, Scheduling Algorithms. Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.	8
3	**Synchronization**: Background, Critical Section Problem, Mutex locks, Semaphores, Classic Problems of Synchronization **Deadlocks**: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock Detection and Recovery from deadlock.	8
4	**Memory management strategies**: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of Page Table **Virtual Memory Management**: Background, Demand paging, copy on write, Page replacement algorithms, Allocation of frames, Thrashing.	8
5	**Implementing File-system**: File-System Structure, File-System Implementation, Directory Implementation, Allocation methods, Free-space management. **Mass-storage structure**: Disk Structure, Disk Attachment, Disk Scheduling. **System Protection**: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	9th	John Wiley & Sons, Inc.	2012

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Modern Operating System	Andrew S. Tanenbaum	3rd	Prentice Hall	2007
2	Operating System: Internals and Design Principles	William Stallings	8th	Prentice Hall	2014
3	Schaum's Outline of Operating Systems (Schaum's Outline Series)	J. Archer Harris	1st	McGraw-Hill	2020

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Operating Systems Guide	Tim Bower	1st	Kansas State Polytechnic	2009	https://infonw.laurensstoop.nl/
2	Operating Systems Course Notes	Dr. John T.Bell	9th	University of Illinois Chicago	2013	https://www.cs.uic.edu/~jbell/CourseNotes/OpeOperatingSyst/index.htht
3	Schaum's Outline of Operating Systems	J. Archer Harris.	1st	McGraw-Hill	2002	https://archive.org/details/schaumsoutlineof0000harr

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Introduction to operating system	Coursera	2024	https://www.coursera.org/courses?query=operating%20system
2	Introduction to operating system	NPTEL	2017	https://onlinecourses.nptel.ac.in/noc20_cs75/preview
3	Introduction to operating system	Udacity	2022	https://www.udacity.com/course/introduction-to-operatingsystems--ud923

Course Outcomes (COs):

CO1	Apply the different concepts and functionalities of Operating System.
CO2	Analyse various Operating system strategies and techniques.
CO3	Demonstrate the different functionalities of Operating System.
CO4	Conduct practical experiments to implement the functionalities of Operating system.

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												3
CO4				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**

Laboratory Plan:

1. Students should write the program (pseudocode) for that week to be executed in the lab at the beginning of each lab and get it corrected by the batch-in-charge faculty and then start with the program execution.
2. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.
3. Continuous Internal Evaluation for each lab is for 10 marks which includes execution of the program in the allotted lab time and showing the output. Observation book needs to be corrected on the same day itself.

Note:

- Student completes the program on the day within the lab timings and shows the output for any given input case: 10 marks
- Student completes the program on the day within the lab timings and shows the output for only some input cases: 8 marks
- Student completes the program on the day and shows the output for any given input case: 6 marks
- Student completes the program on the day within one week and shows the output for any given input case: 4 marks

- Submission any later: 0 marks

4. One Lab Test will be conducted for all the 10 programs. Lab Test will comprise programs which are completely different from the existing lab list of programs.

5. Marks split up for Lab:

Continuous Internal Evaluation: **100 marks → reduced to 10 marks**
Lab Test: **60 marks → reduced to 15 marks** (Writeup- 15 marks, Execution- 25 marks, Modification asked in the program for execution – 10 marks, Viva- 10 marks)

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	1	10	Write a C program to simulate the following CPU scheduling algorithm to find turnaround time and waiting time. (Any one) a) FCFS b) SJF c) Priority d) Round Robin (Experiment with different quantum sizes for RR algorithm)
2	1	10	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.
3	2	10	Write a C program to simulate Real-Time CPU Scheduling algorithms: (Any one) a) Rate- Monotonic b) Earliest-deadline First c) Proportional scheduling
4	3	10	Write a C program to simulate: (Any one) a) Producer-Consumer problem using semaphores. b) Dining-Philosopher's problem
5	3	10	Write a C program to simulate: (Any one) a) Bankers' algorithm for the purpose of deadlock avoidance. b) Deadlock Detection

6	4	10	Write a C program to simulate the following contiguous memory allocation techniques. (Any one) a) Worst-fit b) Best-fit c) First-fit
7	4	10	Write a C program to simulate page replacement algorithms. (Any one) a) FIFO b) LRU c) Optimal
8	5	10	Write a C program to simulate the following file allocation strategies. (Any one) a) Sequential b) Indexed c) Linked
9	5	10	Write a C program to simulate the following file organization techniques. (Any one) a) Single level directory b) Two level directory c) Hierarchical
10	5	10	Write a C program to simulate disk scheduling algorithms. (Any one) a) FCFS b) SCAN c) SSTF d) c-LOOK

SEE Exam Question Paper Format:

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Question 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	20%
Apply / Analyze	60%
Create / Evaluate	20%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Analysis and Design of Algorithms**		
Course Code:	**23CS4PCADA**	**Total contact hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	Introduction to Algorithm, Fundamentals of Algorithmic Problem Solving. **Analysis of Algorithm Efficiency:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithms, Mathematical Analysis of Recursive Algorithms.	8
2	**Brute-Force:** String Matching, Exhaustive Search: Travelling Salesman Problem, Knapsack Problem, Assignment Problem. **Decrease-and-Conquer:** Topological Sorting, Algorithms for Generating Combinatorial Objects: Generating Permutations, Decrease by-a-Constant-Factor Algorithms: Russian Peasant Multiplication, Variable Size-Decrease Algorithms: Computing Median and the Selection Problem.	8
3	**Divide-and-Conquer:** Merge Sort, Quicksort, Multiplication of Long Integers and Strassen's Matrix Multiplication. **Transform-and-Conquer:** Presorting, Heaps and Heap sort, Horner's Rule. **Space and Time Tradeoffs:** Horspool's Algorithm, Boyer-Moore Algorithm.	8
4	**Dynamic Programming:** Coin Problem, The Knapsack Problem, Warshall's Algorithm, Floyd's Algorithms. **Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees, Fractional Knapsack Problem.	8
5	**Backtracking:** n-Queens Problem, Subset-Sum Problem. **Branch-and-Bound:** Knapsack Problem, Traveling Salesman Problem. **NP-Completeness:** Polynomial time, Polynomial-time verification, NP-completeness and reducibility. NP-Complete Problems: The Clique problem, The Vertex Cover problem.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd	Pearson	2014
2	Introduction to Algorithms	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein	3rd	MIT Press	2009

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahni, Rajasekharam	2nd	University Press Pvt. Ltd	2009
2	Analysis and Design of Algorithms	Padma Reddy	1st	Sri Nandi Publications	2009

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction to the Design and Analysis of Algorithms A Strategic Approach	R. C. T. Lee, S. S. Tseng, R. C. Chang, Y. T. Tsai	1st	McGraw Hill Education	2005	https://dilipbyella.wordpress.com/wp-content/uploads/2021/03/r._c._t._lee_shian-shyong_tseng_ruei-chuan_chang_y._t._tsai_-_introduction_to_the_design_and_analysis_of_algorithms_2006_mcgraw-hill_education___asia_-_libgen.lc1_.pdf
2	Data Structures and Algorithm Analysis in C++	Allen Weiss	4th	Pearson Education	2014	https://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/DataStructures.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Design and Analysis of Algorithms	NPTEL	2019	https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2	Design and Analysis of Algorithms	Swayam	2020	https://onlinecourses.swayam2.ac.in/cec20_cs03/preview

Course Outcomes (COs):

CO1	Analyze time complexity of recursive and non-recursive algorithms using asymptotic notations
CO2	Apply various algorithm design techniques for the given problem
CO3	Apply the knowledge of complexity classes P, NP, and NP-Complete and prove certain problems are NP-Complete
CO4	Design efficient algorithms and conduct practical experiments to solve problems.

CO-PO-PSO- Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		3													
CO2	3														
CO3	1	1													
CO4			3	3	1										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:

1. Design, develop and implement the specified algorithms for the following problems using any programming Language in LINUX/Windows environment, preferably using C language.
2. For sorting and searching problems, the program should allow both manual entry of the array elements and also reading of array elements using random number generator. Plot a graph of the time taken versus N using MS Excel and paste the same in the record.
3. Observation book to be maintained for Continuous Internal Evaluation

4. Lab Record–Soft copy of the record.
5. For the first three lab session the students are to be introduced on the Hacker rank/ Leetcode platform to solve problems.
6. One Lab Test will be conducted for all the 11 programs. Lab test will comprise programs which are completely different from the existing lab list of programs.
7. Marks split up for Lab:

Continuous Internal Evaluation: **110 marks → reduced to 10 marks**
Lab Test: **60 marks → reduced to 15 marks** (Writeup- 15 marks, Execution- 25 marks, Modification asked in the program for execution – 10 marks, Viva- 10 marks)

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	-		Leetcode exercises on Stacks, Queues, Circular Queues, Priority Queues.
2	-		Leetcode exercises on DFS, BFS
3	-		Leetcode exercises on Trees and Graphs
4	2	7	Write program to obtain the Topological ordering of vertices in a given digraph.
		3	Leet Code exercises on topological sorting.
5	2	10	Implement Johnson Trotter algorithm to generate permutations.
6	3	10	Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and record the time taken to sort.
7	3	10	Sort a given set of N integer elements using Quick Sort technique and compute its time taken.
8	3	10	Sort a given set of N integer elements using Heap Sort technique and compute its time taken.
9	4	7	Implement 0/1 Knapsack problem using dynamic programming.

		3	Leet Code exercise on Knapsack problem using dynamic programming.
10	4	7	Implement All Pair Shortest paths problem using Floyd's algorithm.
		3	Leet Code exercise on Floyd's algorithm.
11	4	5	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
		5	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
12	4	10	Implement fractional knapsack problem using Greedy technique.
13	4	10	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
14	5	10	Implement "N-Queens Problem" using Backtracking.

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	10%
Apply / Analyze	50%
Create / Evaluate	40%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Software Engineering**		
Course Code:	**23CS4PCSED**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** FAQs about software engineering, FAQ's Continued, Professional and ethical responsibility, Software Process models, Process Iteration, Process Iteration continued, Process Activities, Software requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document.	8
2	**Requirements engineering process:** Feasibility studies, Requirement's elicitation and analysis, Requirements validation, Requirements management. **System models:** Context models, Behavioural models, Data models, Object models, Structured methods.	8
3	**Architectural Design:** Architectural Design Decisions, System organization Modular Decomposition styles, Control styles **Object oriented design**: Objects and Object Classes, An object-oriented design process Design evolution.	8
4	**Software Project Management:** The Management Spectrum, Product, process and project, The W5HH principle, Critical practices, Estimation for Software Project: Software Project estimation, Decomposition Techniques, Empirical Estimation models **Project Scheduling:** Basic Concepts, Project Scheduling, Defining Task set and Task network, Scheduling **Risk Management**: Reactive versus proactive strategies, Software Risks, Risk identification, Risk mitigation, monitoring and management, The RMMM plan.	8
5	**Rapid software development**: Agile methods, Extreme programming, Rapid application development **Software evolution**: Legacy system evolution **Verification and Validation**: Planning verification and validation, Software inspections, Automated static analysis, Verification and formal methods **Software testing:** System testing, Component testing, Test case design, Test automation.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Software Engineering	Ian Somerville	8th	Pearson Education	2007
2.	Software Engineering: A Practitioners Approach	Rogers S Pressman	7th	McGraw-Hill	2007

Reference books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Software Engineering theory and Practice	Shari Lawrence Pflieger, Joanne M Atlec	3rd	Pearson Education	2006
2	Software Engineering Principles and Practice	Waman S Jawadekar	1st	Tata McGraw Hill	2004

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Fundamentals of Software Engineering	Rajib Mall	4th	PHI	2014	https://davcollegetitilagarh.org/wp-content/uploads/2020/09/fundamentals-of-software-engineering-fourth-edition-rajib-mall.pdf
2	Software Engineering: A practitioner's Approach	Roger.S.Pressman	7th	Tata McGraw Hill	2010	https://www.mlsu.ac.in/econtents/16_EBOOK-7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_.pdf
3	An Integrated approach to Software Engineering	Pankaj Jalote	3rd	Springer	2005	https://www.academia.edu/4660479/an_integral_approach_to_software_engineering_BY_PANKAJ_JALOTE

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1.	Software development process and methodologies	Coursera	2020	https://www.coursera.org/learn/software-processes
2.	Foundations of Software Testing and validation	Coursera	2022	https://www.coursera.org/learn/foundations-of-software-testing-and-validation
3.	Software Engineering	Swayam	2019	https://swayam.gov.in/nd1_noc19_cs69/preview

Course Outcomes (COs):

CO1	Ability to apply Software Engineering design techniques and practices for developing a software.
CO2	Ability to analyze the various requirements, design and testing techniques to select the appropriate techniques for the software system.
CO3	Ability to design models for different phases of software development to solve real world problems.
CO4	Ability to manage projects by estimating cost and time required for developing the software product.

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**											**3**		
CO3			**3**										**3**		
CO4			**3**						**2**	**2**	**3**		**3**		

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals	**Best 2 of 3**	**40**
Quiz	**One**	**05**
Lab Component	**---**	**---**
Alternate Assessment Tool (AAT)	**One**	**05**
Total		**50**

AAT Plan:

The students are supposed to select any real-world problem and they have to develop the following:

a. Software Requirements Specification (Functional, non-functional and domain requirements)
b. Software Architecture (Context model, Structural and Control model to be followed with diagrams)
c. Detailed design (Use case diagram, sequence and state/data flow diagrams considering any one scenario)
d. Software Estimation and Schedule (Cost and effort estimation and time-line chart)
e. Test case design (for any 3 scenarios)

Students need to do the presentation and submit a report in the prescribed format.

Sl. No	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 3 to 4 members only
2	2nd	AAT topic selection by each group
3	3rd	Presentation: Student team and topic introduction by each group
4	4th, 5th and 6th	Software Requirement Specification development
5	7th, 8th and 9th	Designing different models
6	10th	Software Cost and Effort Estimation
7	11th	Test Case Design
8	12th	AAT Report Preparation

Rubrics used for Evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Problem Statement and Software Requirements Specification (SRS)	(4-3) problem statement and software requirements are well defined and complete	(2-1) problem statement and software requirements are partially complete	(1-0) problem statement and software requirements are not complete	__/4
Design	(4-3) Able to develop complete use case, Context, State and Sequence diagrams for the SRS	(2-1) Able to develop partial use case, Context, State and Sequence diagrams for the SRS	(1-0) Develop incomplete use case, Context, State and Sequence diagrams for the SRS	__/4

Test Cases	(4-3) All Test cases are identified and well defined	(2-1) Some Test cases are identified and well defined	(1-0) Unable to identify Test case	__/4
Oral communication(Presentation)	(4-3) Clear and effective communication Answers all the questions	(2-1) Communication is clear Answered most of the questions	(1-0) Unclear communication Answered only few of the questions	__/4
Report	(4-3) Clear and Effective writing and adherence to appropriate style guidelines	(2-1) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines	(1-0) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/4
Total				**__/20**

Note: AAT will be evaluated for 20 marks and reduced to 5 marks.

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-2	Mandatory	One Question to be asked for 20 Marks
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	35%
Apply / Analyze	40%
Create / Evaluate	25%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Universal Human Values**		
Course Code:	**22MA4AEUHV**	**Total Contact Hours:**	**25**
L-T-P:	**0-1-0**	**Total Credits:**	**1**

Unit No.	Topics	Hours
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.	6
2	**Understanding Harmony in the Human Being - Harmony in Myself!** 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of 'I' and harmony in 'I' 5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 6. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.	6

3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 2. Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order-from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives	**5**
4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** 1. Understanding the harmony in the Nature 2. Holistic perception of harmony at all levels of existence.	**4**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct	**4**

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Human Values and Professional Ethics	R R Gaur, R Sangal, G P Bagaria	1st	Excel Books	2010

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Jeevan Vidya: Ek Parichaya	A Nagaraj, Jeevan Vidya Prakashan, Amarkantak	1st	Original in Hindi By A. Nagraj	1999

2	Human Values	A. N. Tripathi	2nd	New Age International (P) Limited	2006
3	The Story of My Experiments with Truth	Mahatma Gandhi	2nd	FP Classics	2009
4	Small is Beautiful	E F Schumacher	1st	Trans Infopreneur Inc	2010
5	Slow is Beautiful: New Visions of Community, Leisure, and Joie de Vivre	Cecile Andrews	1st	New Society Publishers	2006
6	Economy of Permanence	J C Kumarappa	2nd	Sarva Seva Sangh Prakashan	2017
7	Bharat Mein Angreji Raj	PanditSunderlal	2nd	Prabhat Prakashan Pvt. Ltd.	2018
8	Rediscovering India	Dharampal	1st	Stosius Inc/Advent Books Division	1983
9	Hind Swaraj or Indian Home Rule	Mohandas K. Gandhi	1st	Jitendra T Desai Navajivan Publishing House	2010
10	India Wins Freedom	Maulana Abdul Kalam Azad	1st	Orient BlackSwan	1988
11	Life of Vivekananda	Romain Rolland	1st	Advaita Ashrama, India	2010

Course Outcomes (COs):

CO1	Conduct self-exploration and distinguish between values and skills, happiness and accumulation of physical facilities, the self and the body, Intension and Competence of an individual
CO2	Analyze the value of harmonious relationship based on trust and respect in personal and professional life
CO3	Examine the role of a human being in ensuring harmony in society and nature
CO4	Apply the understanding of ethics in life and profession

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Assessment Plan for CIE:

Tool	Remarks	Marks
Internals (Quiz)	**One**	**10**
Attendance	--	**05**
Lab Component	**--**	**--**
Alternate Assessment Tool (AAT)	**Two**	**35**
Total		**50**

Multiple Choice Question:(MCQs)	**10 marks**
Attendance: Attendance >95% Attendance 85%-95% Attendance 75%-85%	**05 marks** **03 marks** **NO marks**
Report Submission: i. Each student shall submit a report on his/her experiences about the course contents. ii. The report shall be a maximum of 2 pages and a minimum of 1 page Marks for submission of report within the timelines and as per the format (as specified by the faculty)	**05 marks**
AAT component -Assessment shall be done using rubrics as specified by the faculty	**30 marks**

AAT Plan:

1. **Group Assignment:**
   a. Evaluation for 30 marks. PFA the rubrics for evaluation.
   b. Team size: 3-4
   c. Students should hand write the report. General template to be used.
   d. Topic chosen should be relevant to UHV course

2. **Individual Assignment:**
   a. Evaluation for 5 Marks
   b. Students have to hand write his/her reflections from Unit-1 to Unit-5 w.r.t UHV course. General template to be used.
   c. Minimum number of pages: Two

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only.
2	3rd and 4th	AAT topic selection by each group.
3	5th, 6th, 7th, 8th, 9th and 10th	Presentation: Student team and topic introduction by each group.
4	11th and 12th	AAT Report Preparation.

Rubrics used for evaluation- AAT (Group Assignment): 30 Marks

Criteria	Excellent	Good	Average	Poor	Total
Ability to analyse the values chosen. (Teamwork)	(5) Able to analyse the values chosen in detail.	(4) Able to analyse most of the qualities of the values chosen.	(3) Able to analyse few of the qualities of the values chosen.	(1) Unable to analyse the values chosen in detail.	__/5
Ability to elaborate on the challenges faced of the chosen topic. (Teamwork)	(5) Able to elaborate all the challenges faced of the chosen topic.	(4) Able to elaborate most of the challenges faced of the chosen topic.	(3) Able to elaborate on a few of the challenges faced of the chosen topic.	(1) Unable to elaborate any of the challenges faced of the chosen topic.	__/5
Ability to share experiences. (Individual)	(5) Able to share all experiences.	(4) Able to share most experiences.	(3) Able to share a few of the experiences.	(1) Not confident to share any of the experiences.	__/5
Ability to plan for enhancing this value in the society. (Teamwork)	(5) Able to enhance this value in all aspects of the society.	(4) Able to enhance this value in most aspects of the society.	(3) Able to enhance this value in a few aspects of the society.	(1) Unable to enhance this value in any aspect of the society.	__/5

Ability to communicate on chosen topics. (Individual)	(5) Able to communicate effectively on the chosen topic.	(4) Able to communicate moderately on the chosen topic.	(3) Able to communicate minimally on the chosen topic.	(1) Unable to communicate on the chosen topic.	__/5
Ability to prepare a report. (Individual)	(5) Able to prepare a report in detail.	(4) Able to prepare the report moderately.	(3) Able to prepare the report with minimal content.	(1) Unable to prepare a report appropriately for the chosen topic.	__/5
Total					**__/30**

Note: 1) Group assignment will be evaluated for 30 marks.
2) Individual assignment will be evaluated for 5 marks.

SEE Exam Question paper format:

- Marks for SEE is 50.
- SEE shall have a maximum of 25 MCQs and a duration of 1 hour.
- The conduction of SEE shall be done in online mode with MCQs by the respective course instructor.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**Mobile Application Development**		
Course Code:	**23CS4AEMAD**	**Total Contact hours**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Introduction:

- This practical course engages students in the process of designing and implementing a native mobile app as an extension to a previously developed full stack web application.
- Students will work in teams to design UI/UX using tools like Figma and Sketch, create comprehensive wireframes, and implement the app using React Native or Flutter.
- Teacher allotted for project work to students should teach students technologies like Dart, React, Flutter etc., during Class/Lab hours as per the allotment. Teacher allotted for project work should guide the students in choosing the topic and towards carrying out project work and complete the evaluation of assigned students.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days	Jake Knapp, John Zeratsky, Braden Kowitz	1st	Simon & Schuster	2016
2	Learning React Native Building Native Mobile Apps with JavaScrip	Bonnie Eisenman	2nd	O'Reilly Media	2017

Tutorial Links:

1. https://www.youtube.com/playlist?list=PL4cUxeGkcC9jLYyp2Aoh6hcWuxFDX6PBJ: Flutter for Beginners
2. Complete React Native Developer in 2023: Zero to Mastery [with Hooks]
3. Create High-Fidelity Designs and Prototypes in Figma: https://www.coursera.org/learn/high-fidelity-designs-prototype

Course Outcomes (COs):

CO1	Design and prototype mobile app interfaces, ensuring a user-friendly experience using UI/UX design tools
CO2	Develop and integrate a fully functional native mobile app by applying industry best practices
CO3	Present their projects and compile thorough reports, demonstrating teamwork and reflective learning

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

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

Weekly Activities and Delivery:

Sl. No	Week	Activity	Content deliverables by the assigned teacher
1	1st	Formation of teams and initial brainstorming sessions. Note: Student groups of size 3 or 4	Introduction: Overview of the course and objectives.
2	2nd	Project topic selection by each Group.	UI/UX Design • Training on Figma/Sketch. • Creation of initial design mockups.
3	3rd	Presentation: Student and Project topic introduction by each group	Wireframing and Prototyping • Development of detailed wireframes. • Creation of interactive prototypes.
4	4th, 5th and 6th	Presentation of design layout of the user interfaces and user experiences.	Mobile App Development • Introduction to React Native/Flutter. • Implementation of the mobile app.
5	7th and 8th	Presentation on Mobile app by each group	Testing and Debugging • Testing the mobile app for bugs and issues. • Debugging and finalizing the app.
6	9th, 10th and 11th	Complete Project Work Demonstration by each group	Final Presentation and Evaluation • Presentation of the final mobile app. • Peer evaluation and instructor feedback.
7	12th	Project Report Preparation	

Rubrics for Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Unsatisfactory	Points
UI/UX Design	(16-14) Designs are exceptionally creative and user-friendly, with attention to detail. All elements are consistent and align with the app's purpose.	(13-11) Designs are well thought out and user-friendly but may lack some creativity or attention to detail.	(10) Designs meet the basic requirements but may be inconsistent or lack user-friendliness.	(9-6) Designs are incomplete or not user-friendly, with significant inconsistencies or errors.	(5-0) Little to no effort shown in designs, or designs are entirely missing or unusable.	__/16
Wireframing and Prototyping	(18-14) Wireframes and prototypes are comprehensive, detailed, and clearly demonstrate all functionalities and connections.	(13-11) Wireframes and prototypes are mostly complete with some details missing or unclear.	(10) Basic wireframes and prototypes are provided, but many details are missing or unclear.	(9-6) Wireframes and prototypes are incomplete or poorly executed.	(5-0) Little to no effort shown in wireframes and prototypes, or they are entirely missing.	__/18
Mobile App Implementation	(36-30) The mobile app is fully implemented with excellent functionality, user experience, and code quality.	(29-26) The mobile app is mostly implemented with good functionality and user experience, but there may be some issues with code quality.	(25-20) The mobile app is partially implemented with basic functionality and user experience, and there may be significant issues with code quality.	(19-12) The mobile app is poorly implemented, with numerous issues in functionality, user experience, and code quality.	(11-0) Little to no effort shown in the mobile app implementation, or it is entirely non-functional.	__/36

Teamwork and Collaboration	(10) Everyone works well together, actively contributes, and communicates effectively.	(9-8) The team generally works well together with some good contributions and communication	(7-5) The team works together, but contributions and communication are inconsistent.	(4-2) The team struggles to work together, with few contributions and poor communication.	(1-0) The team does not work well together, with no contributions or communication.	__/10
Presentation	(10) The presentation is clear, engaging, and well-organized, with great use of visuals.	(9-8) The presentation is mostly clear, with good organization and some use of visuals.	(7-5) The presentation is okay but could be more organized, and visuals are used minimally.	(4-2) The presentation is unclear, disorganized, and lacks effective use of visuals.	(1-0) The presentation is completely unclear, disorganized, and does not use visuals.	__/10
Report & Documentation	(10) The report is comprehensive, well-structured, and covers all aspects of the project thoroughly.	(9-8) The report covers most of the project aspects in detail and is generally well-organized.	(7-4) The report covers the basic aspects of the project but may lack detail and organization.	(3-2) The report does not adequately cover the project, with poor organization and lack of detail.	(1-0) The report fails to cover the project, lacks any clear structure, and is missing most required sections.	__/10
Total						**__/100**

Note: The project will be evaluated 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.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**4**		
Course Title:	**UI/UX Design**		
Course Code:	**23CS4AEUIX**	**Total Contact Hours:**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Guidelines:

- This course aims to equip learners with in-depth skills in User Interface (UI) and User Experience (UX) design, highlighting their importance in creating seamless and engaging interactions between users and digital platforms.
- Under this project work, student should wireframe and prototype the software application using UI/UX design tools such as Figma.
- Students can form a group with a minimum of two and maximum of four.
- Teacher allotted for project work should teach UI/UX design tools like Figma, Sketch, etc., during Class/Lab hours as per the allotment. Teacher allotted for project work should guide the students in choosing the topic and towards carrying out project work and complete the evaluation of assigned students.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	A Project Guide to UX Design: For User Experience Designers in the Field or in the Making	Russ Unger, Carolyn Chandler	3rd	New Riders	2023
2	The Elements of User Experience	Jesse James Garrett	2nd	New Riders	2010

Tutorial Links:

1. https://www.codecademy.com/learn/intro-to-ui-ux
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/ui-ux
3. https://www.shiksha.com/online-courses/free-ui-ux-design-courses-certification-training-st305-tg1267
4. https://www.udemy.com/topic/user-experience-design/free/

Course Outcomes (COs):

CO1	Apply the user interface design to solve real-world problems.
CO2	Design wireframe and prototype of software using UI/UX tools.
CO3	Demonstrate teamwork and problem-solving skills in project development.

CO-PO-PSO mapping:

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

Assessment Plan for CIE:

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

Weekly Activities and Delivery:

Week	Activity	Content deliverables by the assigned teacher	Technologies/Skills to be Covered
1st	Formation of groups. Note: Student groups of size 2 or 3 or 4	Introduction to UI/UX design	Overview of UI/UX design using Figma tool.
2nd	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Conceptualizing a software application	Identifying problem and understanding social and environmental issues. Brainstorming and planning prototype of the application focused on a chosen social/environmental issue. Tools for wireframing and prototyping (Figma, Sketch).
3rd, 4th, 5th and 6th	Design Layout of the application	prototype	Define layouts based on project scope and objectives.
7th 8th' and 9th	Design and Development of connecting among different designed pages/layouts.	Wireframe	Development of the project with guidance and a mid-term review to assess progress.
10th	Presentation by each group	Integrating Feedback & Refining Applications	Applying feedback from the mid-term review and refining the prototype for better UI design, User testing and UX improvements.

11th	Complete Project Work Demonstration by each group	Final Project Presentations and Submissions	Students present their completed projects and submit their final work for assessment.
12th	Project Report Preparation		

Rubrics for Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Problem Identification & Relevance	(20-15) Clearly articulates a significant social/environmental issue with insightful, innovative solutions.	(14-10) Recognizes a pertinent issue and offers practical solutions.	(9-5) Identifies a basic issue with standard solutions.	(4-0) Fails to identify a relevant issue or solution.	__/20
Technical Implementation	(20-15) Exemplary implementation of UI/UX design, showcasing efficiency, scalability, and technical excellence.	(14-10) Reliable and proficient technical performance, meeting key objectives.	(9-5) Basic implementation incorporating essential features and functionalities.	(4-0) Inadequate or incomplete technical implementation.	__/20
User Experience & Interface	(20-15) Exceptional UI/UX design, prioritizing intuitiveness and user-friendliness, with a professional standard of execution.	(14-10) Competent UI design focused on usability and functionality.	(9-5) Basic UI design encompassing essential functions and user needs.	(4-0) Poor or non-functional user interface, lacking in user-centricity.	__/20
Group Participation	(10-8) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(7-6) Consistent participation and constructive collaboration within the group.	(5-3) Minimal but noticeable participation and occasional contributions.	(2-0) Lack of active participation and collaboration in the group.	__/10

Presentation	(10-8) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(7-6) Well-structured presentation with clear content and effective delivery.	(5-3) Basic presentation with some structure and varying delivery quality.	(2-0) Disorganized presentation lacking in coherence and adequate content.	__/10
Report & Documentation	(20-15) Comprehensive report covering all project aspects with meticulous documentation, including methodology, design, and future scope.	(14-10) Well-structured report with detailed coverage of project implementation.	(9-5) Basic report with limited content, covering essential project details.	(4-0) Poorly structured and incomplete report, lacking essential details.	__/20
Total					**__/100**

Note: The project will be evaluated 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:	**4**		
Course Title:	**Hardware Interface Design**		
Course Code:	**23CS4AEHID**	**Total Contact Hours:**	**30**
L-T-P:	**0-0-1**	**Total Credits:**	**1**

Guidelines:

- This course aims for the students to gain the necessary knowledge to construct Hardware based applications and use software services for processing and storage of the data produced by the hardware devices
- Under this project work, Students will gain practical experience in the development of Hardware based applications while providing exposure to appropriate hardware and software platforms that require such development.
- Students can form a group with minimum of two and maximum of three.
- Teacher allotted for project work to students should teach architecture of the hardware board and the related components like sensors, actuators and communication modules Teacher allotted for project work should guide the students in choosing the topic and towards carrying out project work and complete the evaluation of assigned students.

Reference Text Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Internet of Things: A Hands-On Approach	Arsheep Bahga, Vijay Madisetti	1st	Orient Blackswan Private Limited	2015
2	Arduino Applied: Comprehensive Projects for Everyday Electronics	Neil Cameron	1st	Apress	2019

Tutorial Links:

1. https://www.coursera.org/learn/introduction-iot-boards
2. https://www.mygreatlearning.com/academy/learn-for-free/courses/arduino-vs-raspberry-pi
3. https://www.shiksha.com/online-courses/free-iot-and-connected-devices-courses-certification-training-st563-tg949?regFlow=N

Course Outcomes (COs):

CO1	Apply the various open source components to solve real world Problem
CO2	Design Intelligent systems using development board by interfacing sensors, communication modules and actuators.
CO3	Demonstrate the working of the application for various real time problems.

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	2	2							3	
CO3									3	3					

Assessment Plan for CIE:

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

Weekly Activities and Delivery:

Week	Activity	Content deliverables by the assigned teacher	Technologies/Skills to be Covered
1st	Formation of groups. Note: Student groups of size 2 or 3	Introduction to Embedded Systems and Architectural components	• Overview of any development board.
2nd	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Conceptualizing an application	• Identifying problem and understanding its hardware implementation • Brainstorming and planning prototype of the application and required hardware components. • Hardware and software tools required to implement project
3rd, 4th, 5th and 6th	Design Layout of the application	Prototype	• Connecting hardware components and testing the functionalities based on project scope and objectives.
7th, 8th and 9th	Design and Development of the complete hardware and integrating with software for final application	Insight to relevant Sensors, actuators and communication modules	• Development of the project with guidance and a mid-term review to assess progress.

10th	Presentation by each group	Integrating Feedback & Refining Applications	• Applying feedback from the mid-term review and refining the prototype for better final application
11th	Complete Project Work Demonstration by each group	Final Project Presentations and Submissions	• Students present their completed projects and submit their final work for assessment.
12th	Project Report Preparation	--	--

Rubrics for Project Evaluation:

Criteria	Excellent	Good	Satisfactory	Needs Improvement	Points
Problem Identification & Relevance	(20-16) Clearly articulates a significant real time problems offers a innovative Hardware solutions.	(15-10) Recognizes a pertinent issue and offers practical solutions.	(9-5) Identifies a basic issue with available solutions.	(4-0) Fails to identify a relevant issue or solution.	__/20
Technical Implementation and usage of hardware components	(20-16) Exemplary implementation using various Hardware Components showcasing efficiency, scalability, and technical excellence.	(15-10) Reliable usage of some Hardware Components meeting key objectives.	(9-5) Basic implementation using limited using Hardware Components incorporating essential features and functionalities	(4-0) Inadequate or incomplete usage of the using Hardware Components	__/20
Hardware and Software integration	(20-16) Exceptionally well developed Hardware and software design with complete integrated functional hardware module	(15-10) Competent development of Hardware and software design focused on usability and functionality	(9-5) Basic Hardware and software design encompassing essential functions	(4-0) Poor or non-functional Hardware and software design	__/20

Group Participation	(10-8) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(7-5) Consistent participation and constructive collaboration within the group.	(4-2) Minimal but noticeable participation and occasional contributions.	(1-0) Lack of active participation and collaboration in the group.	__/10
Presentation	(10-8) Professional, engaging presentation with outstanding usage and Hardware and software components demonstrating exceptional delivery skills.	(7-5) Well-structured presentation with clear content and effective delivery.	(4-2) Basic presentation with some structure and varying delivery quality.	(1-0) Disorganized presentation lacking in coherence and adequate content.	__/10
Report & Documentation	(20-16) Comprehensive report covering all project aspects with meticulous documentation, including methodology, design, and future scope.	(15-10) Well-structured report with detailed coverage of project implementation.	(9-5) Basic report with limited content, covering essential project details.	(9-5) Poorly structured and incomplete report, lacking essential details.	__/20
Total					**__/100**

SEE Exam (50 Marks):

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

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

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/10.1007/978-3-319-24280-4

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Object Oriented analysis and design	NPTEL	2024	https://archive.nptel.ac.in/courses/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

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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).	

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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

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

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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**

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

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

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

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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

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**	

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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%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**5**		
Course Title:	**Environmental studies**		
Course Code:	**23CV5HSEVS**	**Total Contact Hours:**	**15**
L-T-P:	**1-0-0**	**Total Credits:**	**1**

COURSE OBJECTIVE:

The students will be able to develop a sense of responsibility about the environment, natural resources, their conservation and understand the concept, structure and function of different ecosystems and the ill effects of environmental pollution and other environmental issues like population growth, Acid rain, global warming etc.,

Total contact hours = 15 (Weekly 1 Hr.)

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Environmental studies	Geetha Balakrishna	3rd	Sun star publication	2020
2	Ecology	Subramanyam	1st	Tata McGraw Hill	2014
3	Environmental studies	Dr. J.P. Sharma	4th	University Science Press	2019
4	Environmental studies	Smriti Srivastav	1st	Kataria & Sons	2020

Reference Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Environmental studies	Benny Joseph	3rd	McGraw Hill Education	2017
2.	Environmental studies	Dr. D.L. Manjunath	1st	Pearson Education India	2006

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Sustainability Engineering	MOOC	2022	https://www.coursera.org / course / sustain

Course Outcome (COs):

CO1	Discuss the components and impacts of human activities on environment
CO2	Apply the environmental concepts for conservation and protection of natural resources
CO3	Identify and establish relationship between social, economic and ethical values from environmental perspectives.

CO-PO-PSO mapping:

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

CIE Marks:

Conduct 3 Tests, considering best of 2. The pattern of Test paper consists of two parts. Part-A consists of 20 MCQs for 1 mark each; Part-B consists of 3 descriptive questions, 10 marks each. Student should answer 2 full questions from part-B. Two quizzes, each quiz is for 5 marks covering full syllabus.

TOTAL CIE MARKS: 20+20+10=50 MARKS:

SEE Exam Question paper format:

PART-A:

- 20 Multiple Choice Questions Covering full syllabus.
- 1 Mark each, students have to attend all questions 20 Marks.

PART-B:

- Consist of 4 main questions. It may be subdivisions of 3 or 4.
- Each question consists of 10 marks, covering full syllabus.
- Student should answer only 3 full questions. 30 Marks.

SEE TOTAL MARKS: 20+30=50 MARKS

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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

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

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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

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

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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**

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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%

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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

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

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.

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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%

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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**	

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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%

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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.

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) Suggested Guidelines: • Create a WebDriver session. • Navigate to a Web page. • Locate the web elements on the navigated page. • 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.
5	7th, 8th, 9th, 10th and 11th	Presentation by each group	Review and Feedback	
6	12th	Complete project work demonstration Project report preparation	Final Project Presentations and Submissions	

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**

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.

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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

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

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

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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**

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

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.

6th Semester

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Cloud Computing**		
Course Code:	**23CS6PCCCT**	**Total Contact Hours:**	**40**
L-T-P:	**2-1-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Cloud Computing:** Defining Cloud Computing, Cloud Types, The NIST model, Deployment models, Service models, Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing	5
2	**Understanding Abstraction and Virtualization**: Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, VMware vSphere, Understanding Machine Imaging, Capacity Planning, Defining Baseline and Metrics: Baseline measurements	5
3	**Web Services:** Understanding Amazon Web Services, Amazon Web Service Components and Services, Working with the Elastic Compute Cloud (EC2), Working with Amazon Storage Systems, Understanding Amazon Database Services. **Exploring Platform as a Service:** Defining Services Salesforce.com versus Force.com: SaaS versus PaaS Application development	5
4	**Understanding Cloud Security:** Securing the Cloud The security boundary Security service boundary Security mapping Securing Data Brokered cloud storage access Storage location and tenancy Encryption Auditing and compliance **Moving Applications to the Cloud:** Applications in the Clouds, Functionality mapping, Application attributes, Cloud service attributes, System abstraction, Cloud bursting, Applications and Cloud API	5
5	**Kubernetes:** Understanding Kubernetes architecture, Kubernetes Concepts, Kubernetes architecture, The Kubernetes APIs **Microservices:** The Truth About Monoliths, What Are Microservices and How Do They Relate to Event-Driven, SOA, Microservice, and Event-Driven Architectures, Moving from a Monolith to an Event-Driven Architecture	5

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cloud Computing Bible	Barrie Sosinsky	1st	Wiley Publishing, Inc.	2011
2	Mastering Docker	Scott Gallagher, Russ McKendrick	2nd	Packt	2017
3	Mastering Kubernetes	Gigi Sayfan	3rd	Packt	2020

Reference Text Books:

Sl. No.	Book Title	Author	Edition	Publisher	Year
1	Cloud Computing: Theory and Practice	Dan C Marinescu	1st	Elsevier (MK)	2013
2	Cloud Computing Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej Goscinski	1st	Wiley	2014

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Cloud Computing a Hands on Approach	Arshdeep Bahga, Vijay Madisetti	1st	University Press	2013	https://pdfcoffee.com/qdownload/cloud-computing-a-hands-on-approach-arshdeep-bahga-vijay-madisetti-pdf-free.html

MOOC Courses:

Sl. No	Course name	Course Offered By	Year	URL
1	Introduction to Cloud Computing	Coursera	2023	https://www.coursera.org/learn/introduction-to-cloud?action=enroll
2	Cloud Computing	NPTEL	2023	https://onlinecourses.nptel.ac.in/noc23_cs89/preview

Course Outcomes (COs):

CO1	Apply fundamental concepts of Cloud Computing.
CO2	Analyse technological concepts of Cloud Computing.
CO3	Design and development of cloud application using appropriate 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			2	2	3				2	2		2		2	

Assessment Plan for CIE:

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

Tutorial Plan:

Tutorial #	Unit #	Topic
1	1	Demonstration of SaaS application(Demonstrate CRM application suitable platform)
2	3	Demonstration of PaaS application (Create a Trailblazer app on sales force trailhead platform)
3	2	a. Create a virtual machine using VMWare Workstation PRO12 (VMware PlayStation) b. Install Python on created a virtual machine and run a simple program.
4	2	Installation of CloudSim Simulator
5	2	Demonstration and program implementation on CloudSim Simulator
6	5	Demonstration of Dockers and Kubernetes.
7	3	Introduction to Cloud Course on AWS Educate
8	4	Getting Started with Security on AWS Educate
9	2	Getting Started with Compute on AWS Educate
10	5	Complete Getting Started with Serverless on AWS Educate
11	3,4,5	Create an application for data analysis (Use any front-end tool and NoSQL Database as backend), Dockerize the same and host it on a chosen cloud (AWS, Google cloud etc)
12	3,4,5	Create an application for data analysis (Use any front-end tool and NoSQL Database as backend), Dockerize the same and host it on a chosen cloud (AWS, Google cloud etc)

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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Big Data Analytics**		
Course Code:	**23CS6PCBDA**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction to Big Data and Analytics:** Types of Digital Data, Definition of Big data and Analytics, Characteristics of Big Data, Domain Specific Examples of Big Data, Analytics Flow for Big Data, Big Data Stack, Mapping Analytics Flow to Big Data Stack, Case Study: Weather Data Analysis	**8**
2	**CAP theorem, NoSQL:** Types of NoSQL databases, MongoDB– Terms used in RDBMS and MongoDB, MongoDB Query Language: CRUD (Create, Read, Update and Delete) operations, Finding documents based on search criteria, Dealing with Null values , Count, Limit, Sort Skip, Aggregate Functions	**8**
3	**Cassandra** –Features of Cassandra, Keyspaces, CRUD, Collection, Counters, Time to Live (TTL) operations, Practice Examples. Hadoop: Introducing Hadoop, RDBMS verses Hadoop, Distributed Computing Challenges	**8**
4	**Hadoop Overview, Big Data Storge**: HDFS, Batch Analysis**:** Hadoop and MapReduce, Wordcount Demonstration, Hadoop- MapReduce Examples.	**8**
5	**Scala:** The Basics, Control Structures and functions, Working with arrays, Maps and Tuples. **Introduction to Data Analysis with Spark:** Introduction to Apache Spark, A unified Spark, Users of Spark, Storage layers for Spark. Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Big Data Science & Analytics – A Hands-on Approach	Arshdeep Bahga, Vijay Madisetti	1st		2018
2	Big Data and Analytics	Seema Acharya, Subjashini Chellappan	1st	Wiley	2010
3	Scala for the Impatient	Cay S. Horstmann	2nd	Addison-Wesley Professional	2016

4	Learning Spark Lightning-Fast Big Data Analysis	Andy Konwinski, Holden Karau, MateiZaharia, Patrick Wendell	1st	O'Reilly	2015

Reference Text Books:

Sl. No.	Book Title	Author	Edition	Publisher	Year
1	A Textbook on Big Data Analytics	Dr. V. Harsha Shastri, Mrs. V Sreeprada, Mr. T. Udhayakumar, Dr. K. R. Ananth	1st	Notion Press	2023
2	Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning	Raj Kamal, Preeti Saxena	1st	McGraw Hill	2019

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction To Big Data Analytics	Dr. John T Mesia Dhas, Dr. T. S. Shiny Angel, Dr. Adarsh T. K.	1st	Self-published by Dr. John T Mesia Dhas	2022	https://www.ijaeast.com/Introduction%20to%20Big%20Data%20Analytics.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Hadoop Starter Kit	Udemy	2024	Free Hadoop Tutorial - Hadoop Starter Kit | Udemy
2	Big Data Computing	NPTEL	2024	https://nptel.ac.in/courses/106104189

Course Outcomes (COs):

CO1	Apply the concept of NoSQL, Hadoop or Spark for a given task
CO2	Analyse big data analytics mechanisms that can be applied to obtain solution for a given problem.
CO3	Design and implement solutions using data analytics mechanisms for a given problem.

CO-PO-PSO mapping:

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

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. Students should write the program then start with the program execution for that week to be executed in the lab at the beginning of each lab and get it corrected by the batch-in-charge faculty.
2. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.
3. Continuous Internal Evaluation for each lab is for 10 marks which includes execution of the program in the allotted lab time and showing the output. Observation book needs to be corrected on the same day itself.
4. One Lab Test will be conducted (Mostly after theory Test-2) for all the 10 programs. Lab Test will comprise programs which are completely different from the existing lab list of programs.

5. Marks split up for Lab:
Continuous Internal Evaluation: **100 marks → reduced to 10 marks**
Lab Test: **60 marks → reduced to 15 marks** (Writeup- 20 marks, Execution- 30 marks, Viva- 10 marks)

Lab Programs:

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	2	10	MongoDB- CRUD Operations Demonstration (Practice and Self Study)

2	3	10	Perform the following DB operations using Cassandra. a) Create a keyspace by name Employee b) Create a column family by name Employee-Info with attributes Emp_Id Primary Key, Emp_Name, Designation, Date_of_Joining, Salary, Dept_Name c) Insert the values into the table in batch d) Update Employee name and Department of Emp-Id 121 e) Sort the details of Employee records based on salary f) Alter the schema of the table Employee_Info to add a column Projects which stores a set of Projects done by the corresponding Employee. g) Update the altered table to add project names. h) Create a TTL of 15 seconds to display the values of Employees.
3	3	10	Perform the following DB operations using Cassandra. a) Create a keyspace by name Library b) Create a column family by name Library-Info with attributes Stud_Id Primary Key, Counter_value of type Counter, Stud_Name, Book-Name, Book-Id, Date_of_issue c) Insert the values into the table in batch d) Display the details of the table created and increase the value of the counter e) Write a query to show that a student with id 112 has taken a book “BDA” 2 times. f) Export the created column to a csv file g) Import a given csv dataset from local file system into Cassandra column family
4	4	10	Execution of HDFS Commands for interaction with Hadoop Environment. (Minimum 10 commands to be executed)
5	4	10	Implement Wordcount program on Hadoop framework
6	4	10	From the following link extract the weather data https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all a) Create a MapReduce program to find average temperature for each year from NCDC data set. b) find the mean max temperature for every month.

7	4	10	For a given Text file, Create a Map Reduce program to sort the content in an alphabetic order listing only top 10 maximum occurrences of words.
8	5	10	Write a Scala program to print numbers from 1 to 100 using for loop.
9	5	10	Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark.
10	5	10	Write a simple streaming program in Spark to receive text data streams on a particular port, perform basic text cleaning (like white space removal, stop words removal, lemmatization, etc.), and print the cleaned text on the screen. (Open Ended Question).

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	30%
Apply / Analyze	45%
Create / Evaluate	25%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Machine Learning**		
Course Code:	**23CS6PCMAL**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction To Machine Learning** - Machine learning Landscape: Purpose of Machine Learning, examples of applications, Types of ML, main challenges of ML, Testing & Validating End to end Machine learning Project: Working with real data, look at the big picture, Get the data, Discover, and visualize the data, Prepare the data, select, and train the model, Fine tune your model	**8**
2	**Supervised Learning**: Linear Regression, Multiple Linear Regression, Logistic Regression, K Nearest Neighbours, Decision Trees: ID3, Classification and Regression Trees, Support Vector Machines: Linear and Non-Linear, Kernel Functions	**8**
3	**Design And Analysis Of Machine Learning Experiments:** Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm, and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test	**8**
4	**Ensemble Techniques And Unsupervised Learning:** Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: Introduction to Clustering, K-means clustering, Dimensionality reduction-Principal Component Analysis	**8**
5	**Reinforcement Learning**: Introduction, Learning Task, Q Learning, Non-deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Machine Learning	Ethem Alpaydin	4th	MIT Press	2020
2	Hands-on Machine Learning with Scikit- Learn &TensorFlow	Aurelien Geron	2nd	O'Reilly	2019

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Pattern Recognition and Machine Learning	Christopher M. Bishop	1st	Springer	2006
2	Foundations of Machine Learning	Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar	2nd	MIT Press	2018
3	Python Machine Learning	Sebastain Raschka, Vahid Mirjalili	3rd	Packt Publishing	2019
4	Machine Learning	Tom Mitchell	3rd	McGraw Hill	1997
5	Machine Learning: An Algorithmic Perspective	Stephen Marsland	2nd	CRC Press	2014

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Understanding Machine Learning: From Theory to Algorithms	Shai Shalev-Shwartz and Shai Ben-David	1st	Cambridge University Press	2014	https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1	Introduction to Machine Learning	NPTEL	2023	https://nptel.ac.in/courses/106106139

Course Outcomes (COs):

CO1	Apply machine learning techniques in computing systems
CO2	Analyse the given machine learning model.
CO3	Design a model using machine learning algorithms to solve a problem.
CO4	Conduct experiments to solve real-world problems using appropriate machine learning techniques.

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												
CO4			3		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:

1. Students should write the program (pseudocode) for that week to be executed in the lab at the beginning of each lab and get it corrected by the batch-in-charge faculty and then start with the program execution.
2. Soft copy (PDF file) of all the programs along with the output needs to be submitted before the lab test.
3. Continuous Internal Evaluation for each lab is for 10 marks which includes execution of the program in the allotted lab time and showing the output.

Note:

- Student completes the program on the day within the lab timings and shows the output for any given input case: 10 marks
- Student completes the program on the day within the lab timings and shows the output for only some input cases: 8 marks
- Student completes the program on the day and shows the output for any given input case: 6 marks
- Student completes the program on the day within one week and shows the output for any given input case: 4 marks
- Submission any later: 0 marks

4. Open end lab test will be conducted. The scenario-based questions will be asked, the students should identify the appropriate dataset and implement the suitable machine learning model

5. Marks split up for Lab:
Continuous Internal Evaluation: **100 marks → reduced to 10 marks**
Lab Test: **50 marks → reduced to 15 marks** (Write-up- 10 marks, Execution- 20 marks, Modification asked in the program for execution – 10 marks, Viva- 10 marks)

Lab Program	Unit #	Marks for Continuous Evaluation	Program Details
1	--	---	Write a python program to import and export data using Pandas library functions
2	1	10	Demonstrate various data pre-processing techniques for a given dataset
3	2	10	Use an appropriate data set for building the decision tree (ID3) and apply this knowledge to classify a new sample.
4	2	10	Implement Linear and Multi-Linear Regression algorithm using appropriate dataset
5	2	10	Build Logistic Regression Model for a given dataset
6	2	10	Build KNN Classification model for a given dataset.
7	2	10	Build Support vector machine model for a given dataset
8	4	10	Implement Random forest ensemble method on a given dataset.
9	4	10	Implement Boosting ensemble method on a given dataset.
10	4	10	Build k-Means algorithm to cluster a set of data stored in a .CSV file.
11	4	10	Implement Dimensionality reduction using Principle Component Analysis (PCA) method.

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	45%
Create / Evaluate	30%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

(Autonomous College under VTU Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Research Methodology and IPR**		
Course Code:	**23CS6AERML**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Research Methodology:** An Introduction- Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research. **Introduction to Research methodology in Computer Science:** Computer programming, Computer Experiment, Computer Simulation, Concurrent programming, Online Ethnography, Online Focus group, Computer assisted web interviewing, Web based experiments, Methodology, Research, Applied research, online research methods.	**8**
2	**Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. **Reviewing the literature:** Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed.	**8**
3	**Testing of hypothesis:** Basic concepts, P-value approach, Analysis of variance: The ANOVA technique, The basic principle of ANOVA, One-way ANOVA, Two-way ANOVA. Other Nonparametric tests: Wilcoxon Signed Rank Sum Test, Mann Whitney U Test, RUN Test, Kruskul Wallis test.	**8**
4	**Interpretation and Report Writing**: Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation Significance of Report Writing, Different Steps in Writing Report, Layout of a Research Paper, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports, Conclusion.	**8**

5	**Introduction to Intellectual Property**: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents:** Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention, Rights Associated with Patents, Enforcement of Patent Rights. **Copyrights and Related Rights: Classes of Copyrights:** Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. **Trademarks:** Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Research Methodology: Methods and Techniques	Kothari C.R.	4th	New Age International	2018
2	Research Methodology: A Step by Step Guide for Beginners	Ranjit Kumar	3rd	SAGE	2011
3	Research Methodology in Computer Science	Ryhan Ebad	1st	Centrum press	2013
4	Intellectual Property: A Primer for Academia	Prof. Rupinder Tewari, Ms. Mamta Bhardwaj	1st	Publication Bureau, Punjab University	2021

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	An introduction to Research Methodology	Bhanwar Lal Garg, Renu kavdia, Sulochana Agarwal, Umesh Kumar Agarwal	1st	RBSA	2019

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Research Methodology: A Step by Step Guide for Beginners	Ranjit Kumar	3rd	SAGE	2011	http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf
2	Intellectual Property: A Primer for Academia	Prof. Rupinder Tewari, Ms. Mamta Bhardwaj	1st	Publication Bureau, Punjab University	2021	https://dst.gov.in/sites/default/files/E-BOOK%20IPR.pdf

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1	Research Methodology and IPR	NPTEL	2024	https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

Course Outcomes (COs):

CO1	Apply the concepts of research methodology and Intellectual Property Rights in research process
CO2	Analyse various research tools and techniques
CO3	Exhibit integrity and ethical behaviour during the preparation of technical document

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**	**1**		**2**	**2**	**2**		**1**			

Assessment Plan for CIE:

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

AAT Plan:

Students are required to search for recently granted patents, present their findings using PPT's, and submit a detailed report on the same.

Sl. No.	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size of 2 to 4 members.
2	3rd	AAT topic selection by each group
3	4th	Presentation: Student team and topic introduction by each group
4	5th, 6th and 7th	Brief insights of the selected patents.
5	8th , 9th and 10th	Presentation of the technical insights and findings from the selected patents.
6	11th and 12th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Relevance & Selection of Patents along with the associated technical documents	(10-8) Patents along with the associated technical documents selected are highly relevant to the topic chosen.	(7-3) Patents along with the associated technical documents selected are relevant to the topic chosen.	(2-1) Limited understanding of the selected patents along with the associated technical documents.	_/10
Technical Insights & Innovation Analysis	(12-10) Provides thorough analysis of the technical aspects and innovation within the patents, clearly explains the significance of the innovation	(9-3) Basic analysis of technical aspects, lacks depth in explaining the innovation	(2-1) Limited analysis of technical insights or innovation	__/12
Report and presentation	(14-10) Clear and effective writing and adherence to appropriate style guidelines exhibiting integrity.	(9-3) Clear and effective writing for most part and minor errors in adherence to appropriate style guidelines exhibiting integrity.	(2-1) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines exhibiting integrity.	__/14

Participation in Discussions	(4-3) Provided many good ideas; inspired others; clearly communicated Ideas.	(2) Participated in discussions occasionally and made few suggestions.	(1) 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	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	45%
Create / Evaluate	20%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Advanced Computer Networks**		
Course Code:	**23CS6PEACN**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Overview of data communication model** – Internet Multicasting, VPN – Routing Algorithms – BGP, OSPF – Differentiated and Integrated Services – SONET, ATM – MPLS -Next generation Internet architectures, Green Communication Networks, and Data Center Networking	8
2	**High Performance Switching:** Introduction, performance considerations, IP address lookup. Algorithms for IP address lookup and optimization, hardware implementation of address lookup	8
3	Analysis of Network congestion Mechanism, ARQ protocols Multimedia Networking; Implementation of multi-threaded Web Server/Web Proxy with Caching/Filtering features, Sliding Window protocol implementation, performance study of various TCP/IP variants	8
4	**Packet Classification:** Need for packet classification and methods for packet classification. Software Defined Networking (SDN) - Deep Dive (Northbound and Southbound interface), Working with Mininet. Network Function Virtualization (NFV) - Architecture and Concepts	8
5	**Software Defined Network** -Comparison between SDN and traditional networks - SDN controller, Switch design, SDN Controller-Switch Protocols, Open Flow Protocol, Control Overhead & Handoff algorithms. Network Function Virtualization -NFV Architecture, Use cases, NFV Orchestration and NFV for 5G	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Computer Networks	Tanenbaum AS, Wetherall DJ	5th	Pearson Education	2011
2	High Performance Switches and Routers	H. Jonathan Chao, Bin Liu	1st	John Wiley & Sons, Inc.	2007
3	Information-Centric Networks: A New Paradigm for the Internet	Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes	1st	Wiley-ISTE	2013

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Software-Defined Networks: A Systems Approach	Larry Peterson, Carmelo Cascone, Brian O'Connor, Thomas Vachuska, Bruce Davie	2nd	Systems Approach LLC	2021
2	Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology.	B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran, C. Tschudin	RFC 8793	RFC Stream - Internet Research Task Force (IRTF)	2020

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Network Functions Virtualization (NFV) with a Touch of SDN	Rajendra Chayapathi, Syed Farrukh, Hassan Paresh Shah	1st	Pearson Education	2017	https://ptgmedia.pearsoncmg.com/images/9780134463056/samplepages/9780134463056.pdf
2	Software Defined Networks, A Comprehensive Approach	Paul Goransson, Chuck Black, Timothy Culver	2nd	Elsevier Inc.	2017	https://www.sciencedirect.com/book/9780128045558/software-defined-networks

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Network Function Virtualization	Coursera	2024	https://www.coursera.org/learn/network-virtual?irclickid=QZv0lCz8OxyNUfJ1ajTOLyNMUkC1AOR8Z2nYws0&irgwc=1&utm_medium=partners& utm_ source=impact&utm_campaign= 259799 &utm_content=b2c#modules

2	Software Defined Networking	Coursera	2024	https://www.coursera.org/learn/sdn?irclickid=QZv0lCz8OxyNUfJ1ajTOLyNMUkC1AIQQZ2nYws0&irgwc=1&utm_medium=partners&utm_source=impact&utm_campaign=259799&utm_content=b2c#modules

Course Outcomes (COs):

CO1	Apply the principles of high-performance networking devices
CO2	Analyze the various protocols and mechanisms in computer networks and SDN
CO3	Design a network topology for a given scenario and demonstrate the performance analysis

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**														
CO2		**2**													
CO3		**3**	**3**		**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:

Students are supposed to choose and explore any of the network simulators and demonstrate the topology designed for a scenario chosen. Students should explore the network parameters appropriate to the scenario designed and demonstrate the performance analysis done. A report has to be submitted in the prescribed format.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 2 to 4 members only
2	3rd	AAT topic selection by each group
3	4th	Presentation: Student team and topic introduction by each group
4	5th, 6th and 7th	Demonstration of the topology designed for a chosen scenario
5	8th ,9th and 10th	Demonstration of the parameters considered for performance analysis of the topology designed.
6	11th and 12th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of an appropriate Network simulator	(4-3) The network simulator chosen supports the implementation of all the concepts for the chosen scenario.	(2) The network simulator chosen supports the implementation of most of the concepts for the chosen scenario.	(1) The network simulator chosen supports the implementation of few of the concepts for the chosen scenario.	__/4
Selection of scenario for demonstration	(4-3) The chosen scenario has an exceptional scenario.	(2) The chosen scenario has an acceptable scenario.	(1) The chosen scenario has a simple scenario.	__/4
Design and implement the scenario in the chosen simulator	(8-6) The topology design and implementation of the chosen scenario is done with all of the functionalities required	(5-3) The topology design and implementation of the chosen scenario is done with most of the functionalities required.	(2-1) The topology design and implementation of the chosen scenario is done with some of the functionalities required.	__/8
Performance analysis of the designed topology for the chosen scenario.	(8-6) Performance analysis is done for all the basic network parameters on the designed topology	(5-3) Performance analysis is done for most of the basic network parameters on the designed topology	(2-1) Performance analysis is done for some of the basic network parameters on the designed topology	__/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	(2-1) 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	Mandatory	One Question to be asked for 20 Marks
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	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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Blockchain Technology**		
Course Code:	**23CS6PEBLC**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Blockchain Essentials:** The history of Blockchain and Bitcoin, The Growth of Blockchain Technology, Blockchain- Definition, Architecture, Generic elements of a Blockchain, Benefits, Features and Limitations, Types of Blockchain, Consensus. **Decentralization:** Decentralization using Blockchain, Decentralized Applications. **Cryptographic Constructs in Blockchain:** Cryptographic primitives- Hash function, ECC Digital Signature, Zero Knowledge proof, Different types of digital signatures. **Applications of Cryptographic Hash Functions:** Merkel Trees, Patricia Trees, Distributed Hash Table.	8
2	**Consensus Algorithms:** Introducing the Consensus Problem, Analysis and Design, Classification, Algorithms, Choosing an Algorithm. **Transactions:** Transaction Life Cycle, Genesis block, Mining. **Bitcoin:** Overview, Cryptographic Keys, Bitcoin Network, Wallets, Bitcoin Payments, Innovation in Bitcoin, Alternative coins- Introduction, Theoretical Foundations- Alternative Proof of Work.	8
3	**Ethereum:** An Overview, Ethereum Network, Components of Ethereum Ecosystem, Ethereum Virtual Machines **Smart Contracts:** History, Definition, Deploying Smart Contracts. **Solidity:** Variables, Data types, Control Structures, Events, Inheritance, Libraries, Functions, Error Handling. **Smart Contract Security:** Reentrancy, Arithmetic Over/Underflows	8
4	**Decentralized Applications (DApps):** What Is a DApp, A Basic DApp Example, Further Decentralizing the Auction DApp, Storing the Auction DApp on Swarm, The Ethereum Name Service (ENS), From App to DApp.	8
5	**Hyperledger:** Architecture, Projects under Hyperledger, Hyperledger Fabric, Hyperledger Sawtooth. **Tokenization:** Tokenization on a blockchain, Types of tokens, Process of Tokenization, Token offerings	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Mastering Blockchain	Imran Bashir	3rd	Packt	2020
2	Mastering Ethereum: Building Smart Contracts and DApps	Andreas M. Antonopoulos, Dr. Gavin Wood	1st	O'Reilly	2018

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Solidity Programming Essentials	Ritesh Modi	1st	Packt	2018

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Mastering Ethereum: Building Smart Contracts and DApps	Andreas M. Antonopoulos, Dr. Gavin Wood	1st	O'Reilly	2018	https://github.com/ethereumbook/ethereumbook

MOOC Courses:

Sl. No.	Course Name	Course Offered by	URL
1	Blockchain Specialization Course 1: Blockchain Basics Course 2: Smart contracts Course 3: Decentralized Applications Course 4: Blockchain Platforms	Coursera	https://www.coursera.org/specializations/blockchain
2	Blockchain Architecture, Design and Use cases	NPTEL	https://nptel.ac.in/courses/106/105/106105184/

Course Outcomes (COs):

CO1	Apply the principles of Blockchain and Cryptocurrency for a given application
CO2	Analyze the various protocols and mining techniques in Blockchain
CO3	Design Blockchain based solution for a given scenario

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		2													
CO3			3		2				3	2				2	

Assessment Plan for CIE:

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

AAT Plan:

Students need to develop and demonstrate DApps. Team size of 3 to 4 students.
A report has to be submitted in the prescribed format.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of 3-4 members.
2	3rd	AAT topic selection by each group.
3	4th	Presentation: Student team and topic introduction by each group.
4	5th, 6th and 7th	Identifying and exploring the tools required for development of DApps
5	8th, 9th and 10th	Implementation and report preparation.
6	11th and 12th	Demonstration and report submission.

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Design and Implementation of the DApp	(18-12) Design and Implementation of the application using appropriate features for all set objectives showcasing teamwork.	(11-7) Design and Implementation of modules using appropriate features for most of the set objectives, showcasing teamwork.	(6-0) Some of the modules are not implemented in accordance with the design with minimal teamwork.	__/18

Demonstration of DApp	(10-7) Demonstrates the functionality of the application using appropriate reports or plots for various cases.	(6-3) Demonstrates the functionality of the application using appropriate reports or plots for few cases.	(2-0) Demonstrates the functionality of the application without much reporting.	__/10
Oral communication. (presentation)	(5-4) Clear and effective communication. Answered all the questions	(3-2) Communication is clear. Answered most of the questions	(1-0) Unclear communication Answered only few of the questions	__/5
Report	(7-5) 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	(2-0) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines	__/7
Total				**__/40**

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

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Computer Vision and Image Processing**		
Course Code:	**23CS6PECVI**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Image representation, Image digitization, Digital image properties, Color images. **Image pre-processing:** Pixel brightness transformations, Geometric transformations, local pre-processing.	**8**
2	**Segmentation:** Thresholding, Edge- based segmentation, Region based segmentation, Matching.	**8**
3	**Image understanding:** Image understanding control strategies, SIFT, RANSAC, Point distribution models, Active appearance models, Pattern recognition methods in image understanding, Boosted cascade of classifiers, Image understanding using random forests , Scene labelling and constraint propagation, Semantic image segmentation and understanding, Hidden Markov models, Gaussian mixture models and expectation maximization, Basics of projective geometry, A single perspective camera, Scene reconstruction from multiple views.	**8**
4	**Image data compression and motion analysis**: Image data properties, Discrete image transforms in image data compression, Predictive compression methods, Vector quantization, Hierarchical and progressive compression methods, Comparison of compression methods, JPEG and MPEG image compression, Statistical Texture description, Syntactic texture description methods, Hybrid texture description methods, Differential motion analysis methods, Optical Flow, Analysis based on correspondence of interest points, Detection of specific motion patterns, video tracking, motion models to aid tracking.	**8**
5	**Shape representation and morphology:** Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes, Morphology concepts and principles, Binary dilation and erosion, Gray- scale dilation and erosion, Skeletons and object marking, Granulometry, Morphology segmentation and watersheds.	**8**

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Image Processing, Analysis and Machine Vision	Milan Sonka, Vaclav Hlavac, Roger Boyle	4th	Cengage Learning	2013

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Computer Vision – A Modern Approach	Forsyth, Ponce	2nd	Prentice Hall	2011
2	Digital Image Processing	Rafael C. Gonzalez, Richard E. Woods	3rd	Pearson Education	2009

E book:

Sl. No	Book Title	Authors	Edition	Year	Link
1	Introduction to Computer Graphics	David J Eck	1st	2022	https://szeliski.org/Book

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Image Processing and Computer Vision with Python & OpenCV	Udemy	2023	https://www.udemy.com/course/image-processing-and-computer-vision-with-python-opencv
2	Computer Vision and image processing fundamentals	NPTEL	2023	https://archive.nptel.ac.in/courses/108/103/108103174/

Course Outcomes (COs):

CO1	Apply suitable techniques to process and analyse images.
CO2	Analyse appropriate operations for a given scenario.
CO3	Implement various segmentation, compression and morphological algorithms.

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**	**2**					

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Assessment Plan for CIE:

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

AAT Plan:

Students have to develop a simple application using scaling, rotation, shifting, transformation and reflection using Open CV. They are required to present their application and also submit a concluding report.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 allowed.
2	3rd	AAT topic selection by each group.
3	4th	Presentation: Student team and topic introduction by each group.
4	5th and 6th	Detailed study of Open CV.
5	7th, 8th, 9th and 10th	Design and development of the project.
6	11th	Complete code demonstration
7	12th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Very Good	Good	Fair	Poor	Points
Problem Formulation	(8-6) The depth of the problem is exceptionally formulated.	(5-3) The depth of problem is formulated to a sufficient level.	(2) The depth of the problem is weakly formulated.	(1) The problem is not well formulated.	__/8
Implementation	(12-10) The design and implementation is complete and fully correct	(9-7) The design and implementation is almost complete and correct.	(6-3) The design and implementation is partially complete and partially correct.	(2-1) The design and implementation is not complete and is incorrect.	__/12

Output	(10-8) Executes without errors. Thorough and organized testing has been completed.	(7-6) Executes without errors. Testing has been completed on few test cases.	(5-3) Executes with minor errors. Testing has been completed on few test cases.	(2-1) No execution and has errors.	__/10
Documentation and presentation	(10-8) Report is as per specified format and complete. Presentation is clear and exceptional.	(7-5) Report is complete and contents are not as per format. Presentation is clear.	(4-2) Report is incomplete and contents are not as per format. Presentation is moderate.	(1) Report is incomplete, incorrect and does not comply to the format specified. Presentation is unclear.	__/10
Total					**__/40**

Note: The AAT will be evaluated for 40 marks and reduced to 20 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	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	20%
Apply / Analyse	50%
Create / Evaluate	30%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Advanced Data Structures**		
Course Code:	**23CS6PEADS**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No	Topics	Hours
1	**Disjoint Sets:** Basic Data Structure, Smart Union algorithms, Path Compression, Time Complexity for Union-by-Rank, Applications. **Advanced Lists:** Generic Linked List, Memory efficient doubly linked list – XOR Linked List, Skip List, Self-Organizing List, Unrolled LinkedList.	**8**
2	**Self-Balancing Trees:** AVL Trees-Construction, Insertion, Rotation, Deletion, 2-3 Trees–Construction, Insertion and Deletion, B-Trees-Construction, Insertion and Deletion, Red-Black Trees-Construction, Insertion and Deletion, Splay Trees, Scape Goat Tree.	**8**
3	**Advanced Trees:** Trie–Insert, Search, Delete, Segment Tree–Construction, Range Minimum Query, Suffix Array and Suffix Tree–Construction, Substring Check, Binary Indexed Tree or Fenwick Tree - Construction, K Dimensional Tree–Construction.	**8**
4	**Heaps:** Binomial Trees and Binomial Heaps-Operations on Binomial Heaps. Fibonacci Heaps - Operations on Fibonacci heaps, Skew heaps, Pairing heaps.	**8**
5	**Priority Queues:** Model, Simple implementation, Binary Heap: structure property, heap-order property, other operations, d-heaps, Leftlist heaps: property, operations, skew heaps. **Advanced Hashing:** Perfect Hashing, Cuckoo Hashing, Hopscotch Hashing, Universal Hashing.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Algorithms	T. H Cormen, C. E. Leiserson, R. L. Rivest	4th	MIT Press	2022
2	Data Structures and Algorithm Analysis in C++	Marks Allen Wesis	4th	Pearson Education	2013

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahni, Rajase kharam	2nd	Computer Science Press	2009

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Data Structures and Algorithm Analysis in C++	Allen Weiss	4th	Pearson Education	2013	https://www.uoitc.edu.iq/images/documents/informatics-institute / Competitive exam / DataStructures.pdf

MOOC Courses:

Sl. No	Course name	Course Offered By	Year	URL
1	Data Structures and Algorithms	NPTEL	2009	https://nptel.ac.in/courses/106/102/106102064/
2	Programming and Data Structures	NPTEL	2009	https://nptel.ac.in/courses/106105085/

Course Outcomes (COs):

CO1	Apply the concepts of advanced data structures for the given scenario
CO2	Analyze the usage of appropriate data structure for a given application
CO3	Develop solutions for a given scenario using appropriate data structures

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**	**2**					

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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, students have to go through the recent works on Advanced data structure concepts by referring high impact factor Journal articles and Identification of a problem which is feasible and develop innovative idea based on the current work.
- Students should form teams to carry out the implementation. The team size is 3-4 students.

Sl. No	Week	Activity
1	1st	Formation of groups. Note: Student groups of size 3 to 4 members.
2	2nd and 3rd	Referring Journal articles and Identification of a problem statement
3	4th	Presentation of selected problem statement by each group
4	5th, 6th and 7th	Implementation of defined problem statement
5	8th, 9th and 10th	Demonstration of the developed code with results
6	11th and 12th	AAT report preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Point
Referring high impact factor Journal articles and Identification of innovative idea based on the current work.	(8-6) Referred high impact factor Journal articles and identified innovative idea based on the current work.	(5-3) Referred few high impacts factor Journal articles and identified innovative idea based on the current work.	(2-0) Referred Journal articles and identified innovative idea based on the current work.	__/8

Implementation of the problem statement.	(14-10) Implementation of the problem statement has been done accurately showcasing efficiency, integrity, teamwork, scalability, sustainability and technical excellence.	(9-6) Implementation of the algorithm has been done appropriately showcasing integrity, teamwork and technical excellence.	(5-0) Implementation of the algorithm has been done.	__/14
Testing for various cases.	(6-5) The implemented algorithm works for any given valid input.	(4-3) The implemented algorithm works for almost all valid inputs.	(2-0) The implemented algorithm works for some valid inputs.	__/6
Presentation and Report.	(12-10) Clear and effective writing and adherence to appropriate style guidelines, effective communication and full participation in the discussion.	(9-6) Clear and effective writing for the most part with minor errors in adherence to appropriate style guidelines, clear communication and partial participation in the discussion.	(5-0) Unclear and ineffective writing in adherence to appropriate style guidelines, unclear communication, no participation in the discussion.	__/12
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	10%
Apply / Analyze	60%
Create / Evaluate	30%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Artificial Intelligence**		
Course Code:	**23CS6OEAIN**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Definition of AI. 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 Informed Search Strategies: Heuristic functions, Greedy best first search, A*search	**8**
3	**Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic – A very simple logic, syntax, semantics, A simple inference procedure, Propositional theorem proving	**8**
4	**First Order logic:** Syntax and Semantics of First Order logic- Models for first-order logic, Symbols and interpretations, Using First Order Logic Unification- Assertions and queries in first-order logic, The wumpus world	**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 and example	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Artificial Intelligence	Stuart J. Russell, Peter Norvig	3rd	Pearson	2015
2	Artificial Intelligence – Structures and Strategies for Complex problem Solving	George F Luger	6th	Pearson Publication	2009

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B Nair	3rd	Tata McGraw Hill	2013

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-ai.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 system for a given requirement

CO-PO-PSO Mapping:

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

Assessment Plan for CIE:

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

SEE Exam Question paper Pattern:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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	25%
Apply / Analyze	50%
Create / Evaluate	25%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**6**		
Course Title:	**Cryptography**		
Course Code:	**23CS6OECRP**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Security Goals, Cryptographic Attacks, Service & Mechanisms, Techniques. **Mathematics of Cryptography:** Integer Arithmetic, Modular Arithmetic, Linear Congruence.	8
2	**Traditional symmetric-Key Ciphers:** Introduction, Substitution Ciphers, Transposition Ciphers **Mathematics of Symmetric-key cryptography:** Algebraic Structures, GF(2^n) Fields**.**	8
3	**Introduction to Modern Symmetric Key Ciphers:** Modern Block Ciphers, Modern Stream Ciphers. **Data Encryption Standard (DES):** Introduction, DES Structure, DES Analysis, Multiple DES. **Advanced Encryption Standard (AES):** Introduction, Transformations, Key Expansion, AES Ciphers.	8
4	**Mathematics of Asymmetric-Key Cryptography:** Primes, Primality Testing, Chinese Remainder Theorem, Quadratic Congruence.	8
5	**Asymmetric -Key Cryptography:** Introduction, RSA cryptosystem, ElGamal Cryptosystem. Cryptographic hash functions, RSA digital signature, Diffie-Hellman Key Agreement.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography and Network Security	Behrouz A. Forouzan, Debdeep Mukhopadhyay	2nd	Tata McGraw Hill	2013

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography: Theory and Practice	Stinson. D.	3rd	Chapman & Hall/CRC	2012
2	Cryptography and Network Security	Atul Kahate	3rd	Tata McGraw-Hill	2017
3	Cryptography and Network Security Principles and practice	W. Stallings	5th	Pearson Education Asia	2013

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Cryptography and Network Security. Principles and Practice	William Stallings	3rd	Pearson Education	2007	http://williamstallings.com/Crypto3e.html
2	Handbook of Applied Cryptography	Menez, van Oorschot, Vanstone	1st	CRC Press	2001	http://www.cacr.math.uwaterloo.ca/hac/

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Cryptography and Network Security	NPTEL	2024	http://nptel.ac.in/courses/106105031/
2	Cryptography I	Coursera	2019	https://www.coursera.org/course/crypto

Course Outcomes (COs):

CO1	Apply cryptographic techniques to ensure data confidentiality, integrity, and authentication
CO2	Analyze various symmetric and asymmetric cryptosystems and types of attacks on these cryptosystems

CO-PO-PSO Mapping:

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

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Assessment Plan for CIE:

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

SEE Exam Question paper Pattern:

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%

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Semester:	**6**		
Course Title:	**Data Structures using C**		
Course Code:	**23CS6OEDST**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Data Structure**: Introduction to Structures, Introduction to Pointers, Data types – Primitive and Non-Primitive, Types of Data Structures- Linear and Non-Linear Data Structures. **Stacks**-Operations, Array representations of Stacks, Stack Applications - Infix to Postfix conversion, Postfix expression evaluation, Recursion: examples-Factorial, Fibonacci generation.	8
2	**Queues** – Introduction, Linear Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue. **Dynamic Memory Allocation:** Malloc, Calloc, Free, Realloc	8
3	**Linked List** – Singly linked list - Insertion, Deletion and Searching, Circularly linked lists - Insertion, Deletion and Searching, Doubly linked list - Insertion, Deletion and Searching, Applications of linked lists – Linked Implementation of Stacks, Linked Implementation of Queue	8
4	**Trees** – Definitions, Properties of trees, Binary tree, Binary tree representation, Binary tree traversals, Binary tree implementation, Binary Search Tree operations and its implementation, Applications of trees	8
5	**Tree Traversals:** Depth First Search traversal-examples, Breadth First Search traversal-examples. **Hashing**: Hash functions, Collision resolution techniques- Separate chaining, Open addressing - Linear probing, Quadratic probing, Double hashing, Rehashing.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Data Structures in C	Horowitz, Sahni, Anderson Freed	2nd	Universities Press	2008
2	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd	Pearson	2014

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Data Structures using C	Aaron M. Tenenbaum, YedidyahLangsam, Moshe J. Augenstein	5th	Pearson Education	2007

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Data Structures using C	Reema Thareja	2nd	Oxford University Press	2014	http://www.ir.juit.ac.in:8080/jspui/bitstream/123456789/5374/1/Data%20structures%20using%20C%20%202nd%20Ed.%20by%20Thareja%2C%20 Reema%20%282014%29.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Data Structures	Coursera	2022	https://www.coursera.org/learn/data-structures
2	Data Structures and Algorithms	NPTEL	2022	https://nptel.ac.in/courses/106102064/

Course Outcomes (COs):

CO1	Apply the concept of linear and nonlinear data structures
CO2	Analyse data structure operations for a given problem
CO3	Design and develop solutions using an appropriate data structure for a given specification

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**												

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Assessment Plan for CIE:

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

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	30%
Apply / Analyze	45%
Create / Evaluate	25%

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Semester:	**6**		
Course Title:	**Major Project Phase-1**		
Course Code:	**23CS6PWPP1**		
L-T-P:	**0-0-2**	**Total Credits:**	**2**

Guidelines:

1. Students should form teams to carry out the project. The size of the teams can comprise of a minimum of three students and maximum of four students.
2. Teams are free to choose their Internal Guide or will be assigned an Internal Guide by the Department Coordinator.
3. Teams can carry out their project in-house or in a reputed organization (which has to be approved by the Internal Guide). Students taking up industry projects can do so with the condition that they are allowed to demonstrate their project work on the college campus.
4. Identification of a problem which is feasible and innovative based on the current state of art technology and having relevance and social impact, considering the boundaries of societal, environmental and ethical issues.
5. The project should address any one or more than one of the Seventeen Sustainable Development Goals (SDG) given by United Nations. The project should belong to the category of either "Community Oriented Project" or "Multidisciplinary Project" or both.
6. Survey of literature related to the identified problem to make a feasibility study and identify the project requirements. Prepare and submit a synopsis of your project to your respective Guides.
7. Based on the literature review, preparation of review paper and publishing it.
8. Evolve a high-level design/system level architecture and identify the various implementable modules with their input/output needs.
9. Preparation and submission of Project Phase1 technical report.

- In-house project teams should meet their Guides weekly and update about the progress of the projects, whereas the industry project students should meet their Guides once in fifteen days.
- CIE evaluation: Carried out twice in a semester by an internal panel comprising of Internal Guide and at least three other faculty members of the department.
- SEE evaluation: Conducted at the end of the sixth semester by both internal guide and an external examiner from other institutions. Evaluation is based on the team presentation, project report and publication.

Note: CIE and SEE will be evaluated for 100 Marks and will be reduced to 50 Marks.

Course Outcomes (COs):

CO1	Identify a real-life/engineering problem, utilize prior knowledge, and conduct extensive investigation across diverse sources, in addressing the challenges associated with the problem.
CO2	Competence in applying the software engineering principles in planning, formulating an innovative design/ approach and computing the requirements.
CO3	Plan, monitor, and manage project schedule, resources, and work assignments to ensure timely completion.
CO4	Perform professionally—as a team member, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
CO5	Use formal and informal communications with team members and guide, make presentations and prepare technical document.
CO6	Provide sustainable solution within the context of legal framework addressing the societal and environmental concerns and upholding ethical issues.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										3			
CO2		2	2		2							2	2		
CO3											2				
CO4									1						
CO5										1					
CO6						1	1	1							1

Assessment Plan for CIE:

Tool	Remarks	Marks
Evaluation by Guide	--	**48**
Evaluation by Panel	--	**50**
Peer Evaluation	--	**2**
Total		**100**

Rubrics for Project Evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Problem Formulation	(15) Proposed an engineering problem that is relevant to current scenario, innovative, sustainable and practically achievable. Justification for the choice of problem selected. Has identified the functional and non-functional requirement	(14-6) Proposed an engineering problem that is relevant to current scenario and practically achievable. Justification for the choice of problem selected. Has identified the functional and non-functional requirement.	(5-1) Proposed a fair engineering problem and practically achievable. Justification for the choice of problem selected. Has identified the functional and non-functional requirement.	__/15
Planning	(15) Project schedule: Progress, milestones and deliverables with realistic estimates of the time (Gant chart). Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	(14-6) Project schedule: Progress, milestones and deliverables (Gant chart). Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	(5-1) Project schedule: Progress, milestones and deliverables are not planned accordingly. Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	__/15
Literature Survey	(25) Exhaustive/substantial Literature Survey done. Reviewed credible/quality literatures. Clearly summarized the ideas of sources by a thorough review of academic literature. Publication of Literature Review paper.	(24-15) Reviewed credible/quality literatures. Clearly summarized the ideas of sources by a thorough review of academic literature. Publication of Literature Review paper.	(14-1) Reviewed few literatures. Fair summarization of the ideas of sources. Publication of Literature Review paper not done.	__/25

High Level Design	(15) Design is as per problem formulation. Architectural design/ System design: Identifying the sub-systems. Abstract specification of the sub-systems, Interface design. Carefully chosen a methodology or approach that is well-suited to the formulated problem.	(14-6) Design is as per problem formulation. Architectural design/ System design: Identifying the sub-systems. Abstract specification of the sub-systems, Interface design.	(5-1) Design does not target the problem formulation optimally. Architectural design/ System design: Identifying the sub-systems. Abstract specification of the sub-systems, Interface design.	__/15
Report	(10) Clear and Effective writing and adherence to appropriate report format. All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.	(9-6) Writing that is clear and effective for most part and minor errors in adherence to appropriate report format. All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.	(5-1) Unclear and ineffective writing and multiple errors in adherence to appropriate report format. All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.	__/10
Oral communication	(10) Clear and effective communication. Presentation includes appropriate contents and is clearly organized. Presentation highlights key ideas and closes with a strong conclusion. Answer questions/queries professionally.	(9-6) Communication is clear. Presentation includes appropriate contents and is clearly organized. Presentation highlights key ideas. Answer questions/queries professionally.	(5-1) Unclear communication. Presentation includes appropriate contents. Presentation highlights key ideas.	__/10

Group Participation	(4) Did a full share of the work or more and volunteers to help others. Provided many good ideas; inspired others; clearly communicated ideas and needs. Completed assigned work ahead of time.	(3-2) Did almost as much work as others. Participated in discussions; on some occasions, made suggestions. Completed assigned work on time.	(1) Did less work than others. Listened mainly; Rarely spoke up, and ideas were off the mark. Needed much reminding; submission was late.	__/4
Ethics	(4) Upholds the standards of honesty and integrity. Addressed the societal and environmental issues and responsibilities.	(3) Upholds the standards of honesty and integrity. Addressed few societal and environmental issues.	(2-1) Upholds the standards of honesty and integrity.	__/4
Peer Review	To be evaluated by other team members			__/2
Total				**__/100**

Note: The project will be evaluated for 100 marks and reduced to 50 marks.

SEE Exam (50 Marks):

The Project work will be evaluated by an External Examiner along with the Guide.

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

7th Semester

BMS COLLEGE OF ENGINEERING, BANGALORE-19

(Autonomous College under VTU Belagavi)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Network Programming**		
Course Code:	**23CS7PCNWP**	**Total Contact Hours:**	**40**
L-T-P:	**2-1-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Network Programming**: OSI model, Unix standards, UDP, TCP, SCTP, TCP connection establishment and Termination, SCTP Connection establishment and termination, Port Numbers, Buffer sizes and limitations. **Sockets**: Address structures, value – result arguments, Byte ordering and manipulation function and related functions. Elementary TCP sockets.	5
2	**TCP client server**: Introduction, TCP Echo server, TCP Echo Client, Normal startup and Termination, Crashing and Rebooting of server host, Shutdown of server host. **Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket options, IPV4 socket options, IPV6 socket options and TCP socket options, SCTP socket options, fcntl function.	5
3	**Elementary UDP sockets:** Introduction, UDP Echo server, UDP Echo Client, Verifying received response, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **Advanced I/O Functions:** Introduction, Socket Timeouts, recv and send Functions, readv and writev Functions, recvmsg and sendmsg Functions, Queuing of Data, Sockets and Standard I/O, T/TCP: TCP for Transactions.	5
4	**Streams**: Introduction, getmsg and putmsg functions, getpmsg and putpmsg functions, ioctl functions, Transport provider interface. **Broadcasting**: Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions.	5
5	**Multicasting**: Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast_join and Related Functions, dg_cli Function Using Multicasting, Receiving IP Multicast Infrastructure Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol	5

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	UNIX Network Programming	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff	3rd	Pearson Education	2003

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Internetworking With TCP/IP Vol I: Principles, Protocols and Architecture	Douglas E. Comer	6th	Pearson	2014
2	Unix System Programming Using C++	Terrence Chan	1st	Prentice Hall India	2011

MOOC Course:

Sl. No.	Course name	Course offered by	Year	URL
1	Socket Programming in Java	Mind Luster	2024	https://www.mindluster.com/certificate/4049

Course Outcomes (COs):

CO1	Apply the fundamental concepts of network programming
CO2	Analyse the different network programming constructs
CO3	Demonstrate the communication process in networks

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**				**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**

Tutorial Plan:

Tutorial #.	Unit #.	Topic
1	1	Byte ordering, byte manipulation functions- Program to determine host byte order.
2	2	Program to illustrate the use of socket functions such as Socket, connect, bind, listen, accept, fork and exec functions.
3	2	Demonstration of TCP/UDP Echo Client and TCP/UDP Echo Server.
4	2	Program to demonstrate different socket options supported.
5	3	Demonstrate the task of sending and receiving messages using socket functions.
6	4	Demonstration of programs using Transport Provider Interface (TPI).
7	5	Program to demonstrate message broadcasting.
8	--	Design of the network scenario.
9	--	Implementation of the network scenario to demonstrate the communication.
10	--	Implementation of the network scenario to demonstrate the communication.
11	--	Implementation of the network scenario to demonstrate the communication.
12	--	Demonstration of the network scenario by student teams.

AAT Plan:

Students are supposed to form a group with a team size of 3 to 4. The team has to choose an appropriate network scenario that demonstrates the communication between sender and receiver nodes and implement the same using the constructs learnt in C/C++ programming language.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only
2	3rd and 4th	AAT topic selection by each group
3	5th, 6th,7th and 8th	Design of the chosen scenario
4	9th, 10th and 11th	Implementation of the various functionalities of the chosen network scenario
5	12th	AAT Report Preparation and submission

Evaluation Rubrics for AAT:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of scenario for demonstration	(8-5) The chosen scenario has an exceptional application. It demonstrates most of the network programming concepts.	(6-4) The chosen scenario has an acceptable application. It demonstrates some of the network programming concepts.	(3-1) The chosen scenario has a simple application. It demonstrates few of the network programming concepts.	__/ 8
Implementation of the given scenario	(12-8) The scenario has been implemented using most of the networking constructs and with minimal errors.	(7-4) The scenario has been implemented using some of the networking constructs and with some errors.	(3-1) The scenario has been implemented using minimal networking constructs and some errors.	__/12
Report	(12-8) Clear and effective writing and adherence to appropriate style guidelines.	(7-4) Writing that is clear and effective for the most part and minor errors in adherence to appropriate style guidelines.	(3-1) Unclear and ineffective writing and multiple errors in adherence to appropriate style guidelines.	__/12
Oral communication (presentation)	(4) Clear and effective communication.	(3-2) Communication is clear.	(1) Unclear communication.	__/4
Participation in Discussions	(4) Answered all questions and provided many good ideas.	(3-2) Answered all questions.	(1) Answered some questions.	__/4
Total				**__/40**

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

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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	35%
Apply / Analyze	40%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester	**7**		
Course Title:	**Management and Entrepreneurship**		
Course Code:	**22CS7PCMNE**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Definition of Management, Managing: Science or Art, Patterns of Management Analysis: A management theory jungle, The system approach to management process, The functions of managers. **Planning:** Essentials of Planning and Managing by Objectives.	8
2	**Decision Making Organizing**: Formal and informal organization, Organizational Division, Organizational Levels and the span of management, Reengineering the organization, Structure and process of organizing; Line/Staff Authority, Empowerment and Decentralization. **Leadership:** Defining Leadership, Ingredients of Leadership, Trait approaches to leadership, Leadership behaviour and styles.	8
3	**The Project Environment:** Internal and External Environment, Programs, Mission, Goals, Objectives and Strategy, Portfolios Management, Scoring Matrix, Financial Evaluation Criteria. **Integration**: The Charter, Project Management Plan. **Scope**: Beginning the Scope, Scope Contents, Triple Constraints, Priority Matrix, Scope Issues Sample Scope Statement.	8
4	**Entrepreneurship:** Importance of entrepreneurship, concepts of entrepreneurship, characteristics of a successful entrepreneur, classification of entrepreneurs, myths of entrepreneurship, entrepreneurial development models, problems faced by entrepreneurs and capacity building for entrepreneurship. **Women Entrepreneurs**: Women entrepreneurship defined, women entrepreneurship environment, challenges in the path of women entrepreneurship, strategies for development of women entrepreneurs.	8
5	**Creativity and business idea:** Ideas from Trends analysis: Trends, sources of new ideas, methods of generating ideas. **Innovation**: Entrepreneurial innovation, opportunity recognition, product planning and development process, eCommerce and business start-up. **The Business plan**: What is business plan, who should write the plan, scope and value of business plan, Writing the business plan, Using and implementing the business plan.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Management: A Global and Entrepreneurial Perspective	Heinz Weihrich, Mark V Cannice, Harold Koontz	13th	Tata McGraw Hill	2011
2	The Art and Science of Project Management	Roger Warburton, Vijay Kanabar	2nd	RW Press Newport	2013
3	Entrepreneurship Development-Small Business Enterprises	Poornima M. Charantimath	1st	Pearson Education	2009
4	Entrepreneurship	Robert D Hisrich, Mathew J Manimala, Michael P Peters, Dean A Shepherd	9th	Tata McGraw Hill	2014

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Principles of Management	P.C.Tripathi, P.N.Reddy	7th	Tata McGraw Hill	2021
2	Dynamics of Entrepreneurial Development and Management	Vasant Desai	1st	Himalaya Publishing House	2022
3	Entrepreneurship Development	S.S. Khanka	1st	S Chand	2020
4	Project Management for Business, Engineering and Technology	Nicholas J., Steyn	5th	Elsevier	2017

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Management and Entrepreneurship	Veerabhadrappa Havinal	1st	New Age International (P) Limited	2009	http://dspace.vnbrims.org:13000/xmlui/bitstream/handle/123456789/4983/Management%20and%20Entrepreneurship.pdf?sequence=1
2.	Software Project Management	Bob Hughes, Mike Cotterell	2nd	Tata McGraw Hill	2009	https://books.google.co.in/books?id=IMsvEAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Entrepreneurship Specialization	Coursera	2024	https://www.coursera.org/specializations/wharton-entrepreneurship
2	Professional Certificate in Innovation and Entrepreneurship	Edx	2024	https://www.edx.org/certificates/professional-certificate/usmx-innovation-and-entrepreneurship
3	Business Planning & Project Management	NPTEL	2020	https://onlinecourses.swayam2.ac.in/cec20_mg07/preview
4	Fundamentals of Project Planning and Management	Coursera	2024	https://www.coursera.org/learn/uva-darden-project-management

Course Outcomes (COs):

CO1	Apply appropriate Management and Entrepreneurial skills for managing business
CO2	Analyse the different Management and Entrepreneurial strategies that aids in the effective functioning of an organization
CO3	Apply and Analyse Software Project management concepts for software development
CO4	Design a business plan and estimate the plan using appropriate tool

CO-PO-PSO mapping:

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

Students have to choose a topic of their interest such as e-commerce website, textile business, healthcare etc., and write a detailed business plan.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only.
2	3rd	AAT topic selection by each group.
3	4th	Presentation: Student team and topic introduction by each group.
4	5th, 6th and 7th	First Review of business plans by student groups.
5	8th, 9th and 10th	Second review of estimation of the plan using appropriate tool.
6	11th and 12th	AAT Report Preparation and submission.

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Identify and design a business plan	(10-8) Strong introduction of topic, clear delineation of business plan.	(7-4) Conveys topic and business plan moderately.	(3-0) Doesn't effectively convey the topic and business plan.	__/10
Selection of an appropriate tool	(10-8) The tool chosen supports the estimation of all the concepts for the chosen business plan.	(7-4) The tool chosen supports the estimation of some of the concepts for the chosen business plan.	(3-0) The tool chosen supports the estimation of few of the concepts for the chosen business plan.	__/10
Report	(10-8) Clear and effective writing and adherence to appropriate style guidelines.	(7-4) 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
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.	(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	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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Software Architecture**		
Course Code:	**23CS7PESWA**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Software Architecture**: Architectural Structures and Views Architectural Patterns, A Good Architecture. **Contexts of Software Architecture:** Architecture in a Technical Context, Architecture in a Project Life-Cycle Context, Architecture in a Business Context, Architecture in a Professional Context, Stakeholders, Influence of Architecture. **Understanding Quality Attributes:** Architecture and Requirements, Functionality, Quality Attribute Considerations, Specifying Quality Attribute Requirements, Achieving Quality Attributes through Tactics, Guiding Quality Design Decisions. **Other Quality Attributes*:*** Other Important Quality Attributes, Other Categories of Quality Attributes, Software Quality Attributes and System Quality Attributes, Using Standard Lists of Quality Attributes or Not, dealing with "X-ability": Bringing a New Quality Attribute into the Fold.	**8**
2	**Architectural Tactics and Patterns:** Architectural Patterns, Overview of the Patterns Catalogue, Relationships between Tactics and Patterns, Using Tactics Together. **Quality Attribute Modelling and Analysis:** Modelling Architectures to Enable Quality Attribute Analysis, Quality Attribute Checklists, Thought Experiments and Back-of-the-Envelope Analysis, Experiments, Simulations, and Prototypes, Analysis at Different Stages of the Life Cycle.	**8**
3	**Architecture in Agile Projects:** Quantity of Architecture, Agility and Architecture Methods, A Brief Example of Agile Architecting, Guidelines for the Agile Architect. **Architecture and Requirements:** Gathering ASRs from Requirements Documents, Gathering ASRs by Interviewing Stakeholders, Gathering ASRs by Understanding the Business Goals, Capturing ASRs in a Utility Tree, Tying the Methods Together. **Designing an Architecture:** Design Strategy, The Attribute-Driven Design Method, The Steps of ADD.	**8**

4	**Documenting Software Architecture:** Uses and Audiences for Architecture Documentation, Notations for Architecture Documentation, Views, Choosing the Views, Combining Views Building the Documentation Package, Documenting Architecture in an Agile Development Project. **Architecture Implementation and Testing:** Architecture and Implementation, Architecture and Testing. **Architecture Evaluation :** Evaluation Factors, The Architecture Trade-off Analysis Method, Lightweight Architecture Evaluation.	**8**
5	**Role of UML in software architecture.** **Economic Analysis of Architectures:** Decision-Making Context, The Basis for the Economic Analyses, Putting Theory into Practice: The CBAM, Case Study: The NASA ECS Project. **Architecture and Software Product Lines:** An Example of Product Line Variability, working of a Software Product Line, Product Line Scope, The Quality Attribute of Variability, The Role of a Product Line Architecture, Variation Mechanisms, Evaluating a Product Line Architecture.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Software Architecture in Practice	Len Basss, Paul Clements, Rick Kazman	3rd	Addison-Wesley	2013

References Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Software Architecture: The Hard Parts	Neal Ford, Mark Richards, Pramod Sadalage, Zhamak Dehghani	1st	O'Reilly Media	2021
2	Software Architect's Handbook	Joseph Ingeno	1st	Packt	2018

MOOC Courses:

Sl. No.	Course Name	Course Offered By	Year	URL
1	Software Architecture	Coursera	2024	https://www.coursera.org/learn/software-architecture
2	Software Architecture	Class Central	2024	https://www.classcentral.com/course/software-architecture-9217

Course Outcomes (COs):

CO1	Apply the principles of software architecture and its qualities
CO2	Analyze the principles and guidelines of software architectural design, styles, patterns, and frameworks
CO3	Demonstrate the effectiveness of using Software architecture techniques in application development

CO-PO-PSO Mapping:

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

The objective of AAT is to build a software system according to an architectural design by following each step in a defined architectural process. The team will implement architectural patterns currently used in industry and document the architecture system using UML diagrams.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 2 to 4 members only
2	3rd	AAT topic selection by each group
3	4th	Presentation: Student team and topic introduction by each group
4	5th, 6th and 7th	Identification of the significant modules, Architecture Designs, patterns and quality attributes for the proposed model.
5	8th, 9th and 10th	Demonstration of various functionalities of the proposed model utilizing the identified architectural design, patterns and quality requirements.
6	11th and 12th	AAT Report Preparation

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Choose scenarios and design models to establish the business functionality for the software system. (The scenario must have at least three separate quality requirements)	(8-6) Scenario chosen is appropriate and the model has all quality requirements.	(5-3) Scenario chosen is appropriate and the model satisfies most of the quality requirements.	(2-1) Scenario chosen is appropriate and the model caters limited quality requirements.	__/8
Identify and apply architectural tactics, patterns and software quality attributes.	(16-10) Architectural tactics, patterns and relevant software quality attributes are identified and applied.	(9-5) Identified and applied Architectural tactics, patterns and software quality attributes lack cohesiveness.	(4-1) Identified and applied Architectural tactics, patterns and software quality attributes are incompatible.	__/16
Report	(8-6) Clear and Effective writing and adherence to appropriate style guidelines.	(5-3) Writing is clear and effective, 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.

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Question to be asked for 20 marks each
Unit-2	Mandatory	One Question to be asked for 20 marks
Unit-3	Internal Choice	Two Question 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

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Soft Computing**		
Course Code:	**23CS7PESCN**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Introduction, soft computing vs. hard computing, various types of soft computing techniques, and applications of soft computing. Basic tools of soft computing – Fuzzy logic, neural network, evolutionary computing. Introduction: Neural networks, application scope of neural networks, fuzzy logic, genetic algorithm, and hybrid systems	**8**
2	**Fuzzy Sets and Logic:** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications and Defuzzifications	**8**
3	**Evolutionary Computing:** Basic Evolutionary Processes, EV: A Simple Evolutionary System, Evolutionary Systems as Problem Solvers, A Historical Perspective, Canonical Evolutionary Algorithms - Evolutionary Programming, Evolution Strategies, A Unified View of Simple EAs- A Common Framework, Population Size	**8**
4	**Hybrid Soft Computing Techniques:** Introduction, Neuro Fuzzy Hybrid Systems, Comparison of Fuzzy Systems with Neural Networks, Characteristics of Neuro-Fuzzy Hybrids, Classification of Neuro Fuzzy Hybrid Systems, Genetic Neuro-Hybrid Systems: Properties of Genetic Neuro Hybrid Systems.	**8**
5	**Neuro Fuzzy Modeling:** **ANFIS:** Adaptive Neuro Fuzzy Inference Systems: Introduction, ANFIS Architecture, Hybrid Learning Algorithm, Learning Methods that cross fertilize ANFIS and RBFN, ANFIS as a Universal Approximator **Co-active Neuro Fuzzy Modelin**g: Towards Generalized ANFIS: Introduction, Framework, Neuron Functions for Adaptive networks, Neuro Fuzzy Spectrum.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Principles of soft computing	S.N.Sivanandam, S.N.Deepa	3rd	Wiley India	2019

2	Neuro-Fuzzy and Soft Computing	J. S. R. Jang, C. T. Sun, E. Mizutani	1st	Pearson Education	2004
3	Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications	S. Rajsekaran, G. A. Vijayalakshmi Pai	1st	Prentice Hall of India	2003
4	Evolutionary Computation: A Unified Approach	De Jong	1st	MIT Press	2006

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Soft Computing & Intelligent Systems Theory & Applications	N. K. Sinha , M. M. Gupta	1st	Academic Press	2009
2	Computational Intelligence: Concepts to Implementation	R. Eberhart , Y. Shi	1st	Morgan Kaufman	2007
3	Fuzzy Logic with engineering applications	Timothy J. Ross	3rd	Wiley India	2011
4	Computational Intelligence: An Introduction	Andries P. Engelbrecht	2nd	Wiley India	2009

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Fundamentals of Soft Computing	Dr. Kuntal Baruadr	1st	BPB Publications	2017	https://www.academia.edu/35476156/Fundamentals_of_Soft_Computing
2	Fuzzy Logic and Neural Networks by	Chennakesava R. Alavala	1st	New Age International (P) Limited	2008	https://www.academia.edu/1435724/Fuzzy_Logic_and_Neural_Networks_by_Chennakesava_R_Alavala

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Introduction To Soft Computing	NPTEL	2021	https://onlinecourses.nptel.ac.in/noc22_cs54/preview

2	Fuzzy Logic and Neural Networks	NPTEL	2018	https://onlinecourses.nptel.ac.in/noc21_ge07/preview

Course Outcomes (COs):

CO1	Apply the concepts of soft computing techniques to solve engineering problems
CO2	Analyse the evolutionary algorithms and fuzzy logic reasoning to handle uncertainty
CO3	Demonstrate algorithms to solve combinatorial optimization problems

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

AAT Plan:

As an AAT for Soft computing course students will apply the soft computing techniques and evolutionary algorithms studied in the theory to solve combinatorial problems.

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

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups: Student groups of size 3 to 4 is formed.
2	3rd	Selection of problem statement by each group.
3	4th	Presentation: Introduction of the team and Introduction of the problem statement chosen.
4	5th and 6th	Presentation of the Algorithm/technique to solve the problem.
5	7th	Data pre-processing for solving the problem.
6	8th, 9th and 10th	Design and development of the algorithm.
7	11th	Report Preparation.
8	12th and 13th	Complete Solution Presentation and evaluation.

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Choosing the appropriate problem statement and the appropriate optimization technique to solve the problem.	(10-8) Problem statement chosen is appropriate and the most appropriate optimization technique is used to solve the problem.	(7-5) Problem statement chosen is appropriate but the optimization technique chosen to solve the problem is inappropriate.	(4-1) Problem statement chosen is not optimization problem, the optimization technique chosen is inappropriate.	__/10
Implementation of the Algorithm and Testing for various inputs.	(10-8) Implementation of the optimization technique has been done accurately without the usage of any library functions and produces correct output for any given input in a team.	(7-5) The team will Implement the optimization technique appropriately without the usage of any library functions, but not all test cases are passed.	(4-1) The team will Implement the algorithm with usage of few library functions. Not all test cases are passed.	__/10
Application / Relevance	(10-8) The optimized solution has several applications in real life.	(7-5) The solution designed has few applications in real life.	(4-1) The designed solution has few applications and is not very relevant.	__/10
Presentation and Report	(10-8) Presents the solution clearly and confidently, with appropriate volume and pace. Clear and Effective writing and adherence to appropriate style guidelines.	(7-5) Presents the solution with minor issues in volume or pace. Writing is clear and effective, minor errors in adherence to appropriate style guidelines.	(4-1) Often unclear, with significant issues in volume or pace. 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	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
Apply	40%
Analyze	35%
Create / Evaluate	25%

BMS COLLEGE OF ENGINEERING, BANGALORE-19

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Natural Language Processing**		
Course Code:	**23CS7PENLP**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Overview and language modelling** **Overview:** Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval. Language Modelling: Various Grammar - based Language Models, Statistical Language Model.	8
2	**Word level and syntactic analysis** **Word Level Analysis:** Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word Classes, Part-of-Speech Tagging. **Syntactic Analysis:** Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.	8
3	**Semantic analysis and Discourse processing** **Semantic Analysis**: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. **Discourse Processing:** Cohesion, Reference Resolution, Discourse Coherence and Structure.	8
4	**Natural language generation and machine translation** **Natural Language Generation:** Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG, Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.	8
5	**Application and lexical resources** Information Extraction, Automatic Text Categorization and Text Summarization, Question Answering System. **Lexical Resources:** Word Net, Frame Net, Stemmers, Research Corpora.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U.S. Tiwary	1st	Oxford University Press	2008

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition	Daniel Jurafsky, James H Martin	3rd	Prentice Hall	2019
2	Natural Language Processing: Python and NLTK	Deepti Chopra, Jacob Perkins, NitinHardeniya	1st	Packt	2016

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Natural Language Processing	NPTEL	2012	https://nptel.ac.in/courses/106101007/
2	Natural Language Processing	NPTEL	2023	https://onlinecourses.nptel.ac.in/noc23_cs80

Course Outcomes (COs):

CO1	Apply various Natural language processing techniques
CO2	Analyse the different Natural language processing techniques
CO3	Design and develop an application using Natural Language Processing tools

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			2		2			2	1	1				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:

Students are required to explore key problems that NLP can address and develop an NLP application using TensorFlow, PyTorch, spaCy and NLTK libraries. A report must be submitted in the specified format.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only.
2	3rd	AAT topic selection by each group.
3	4th	Presentation: Student team and topic introduction by each group.
4	5th, 6th and 7th	Demonstration of the significant modules of the Natural processing Techniques through simple case studies.
5	8th, 9th and 10th	Demonstration of the various functionalities validating the different scenario chosen in the natural language processing techniques.
6	11th and 12th	AAT Report Preparation.

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of scenario for demonstration.	(8-6) The chosen scenario has an exceptional application. It demonstrates most of natural language processing techniques.	(5-3) The chosen scenario has an acceptable application. It demonstrates some of natural language processing techniques.	(2-0) The chosen scenario has a simple application. It demonstrates few of natural language processing techniques.	__/8
Ability to exhibit integrity and ethical behavior while exploring the chosen natural processing techniques to validate the various Functionalities.	(8-6) Able to effectively exhibit integrity and ethical behavior in the chosen NLP technique to validate all the functionalities.	(5-3) Able to effectively exhibit integrity and ethical behavior in the chosen NLP technique to validate most of the functionalities.	(2-0) Able to effectively exhibit integrity and ethical behavior in the chosen NLP technique to validate some of the functionalities.	__/8

Development of an application for the given Problem Requirement.	(8-6) Development of the application has been done comprehensivel y using natural language processing techniques with valid output.	(5-3) Development of the application has been done moderately using natural language processing techniques with partial output.	(2-0) Development of the application has been done moderately using natural language processing techniques with Invalid 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 occasionally and made few 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	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	30%
Apply / Analyze	50%
Create / Evaluate	20%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Wireless and Mobile Communication**		
Course Code:	**23CS7PEWMC**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Applications and requirements of wireless services**: History, Types of Services, Requirements for the services, Economic and social aspects. **Technical Challenges of wireless communications:** Multipath propagation, Spectrum limitations, Limited energy, User mobility.	8
2	**Cellular Wireless Networks:** Principles of cellular networks, First-General Analog, Second generation TDMA, Second generation CDMA, Third generation systems. **Antennas and wave propagation:** Antennas, Propagation Modes. **Wireless Systems Operations and Standards:** Cordless systems, Wireless local loop, WiMAX and 802.16 broadband wireless access standards.	8
3	**Wireless LAN Technology:** Overview, Infrared LANs. **Wi-Fi and IEEE 802.11:** IEEE 802.11 Architecture, IEEE 802.11 Architecture and services **Bluetooth and IEEE 802.15:** Overview, Radio Specification, **IEEE 802.15 -** IEEE 802.15.3- Medium access control.	8
4	**Telecommunication Systems:** GSM, TETRA, UMTS and IMT-2000. **Satellite Systems:** Applications, Basics, Routing, Localisations, Handover. **Mobile IP and Wireless Application Protocol:** Mobile IP, Wireless Application Protocol	8
5	**Mobile Transport Layer:** Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks. **Support for Mobility:** World Wide Web, Wireless Application Protocol (version 1.x), WAP 2.0.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Wireless Communications	Andreas F Molisch	1st	Wiley, India	2010
2	Wireless Communications and Networks	William Stallings	2nd	Pearson	2013
3	Mobile Communications	Joschen Schiller	2nd	Pearson	2014

Reference Books:

Sl. No	Book Title	Authors	Edition	Publisher	Year
1	Wireless Communications Principles and practices	Theodore S. Rappaport	2nd	Pearson	2018
2	Mobile Communications Engineering: Theory and Applications	William C. Y. Lee	2nd	McGraw-Hill Publications	2017

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Wireless and Mobile Networking	Mahbub Hassan	1st	CRC Press	2022	https://www.researchgate.net/publication/360956823_Wireless_and_Mobile_Networking

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Introduction To Wireless and Cellular Communications	NPTEL	2023	https://nptel.ac.in/courses/106106167
2	Wireless Network	Udemy	2023	https://www.udemy.com/course/wireless-network-q/

Course Outcomes (COs):

CO1	Apply the concepts of cellular, wireless and mobile standards in wireless environments
CO2	Analyse the functionalities of various wireless technologies
CO3	Explore a network simulator and demonstrate the working of a wireless scenario

CO-PO-PSO Mapping:

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

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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 are supposed to explore any of the network simulators and demonstrate the working of a wireless scenario. A report has to be submitted in the prescribed format. Also, a demonstration of simulated scenarios (preferably with code) along with a report has to be submitted.

Sl. No	Week	Activity
1	1st and 2nd	Formation of groups. Note: Student groups of size 3 to 4 members only.
2	3rd	AAT topic selection by each group.
3	4th	Presentation: Student team and topic introduction by each group.
4	5th, 6th and 7th	Demonstration of the significant modules of the network simulators through simple case studies.
5	8th, 9th and 10th	Demonstration of the various functionalities validating the wireless scenario chosen in the chosen network simulator.
6	11th and 12th	AAT Report Preparation.

Rubrics used for evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Selection of scenario for demonstration	(8-6) The chosen scenario has an exceptional application. It demonstrates most of the wireless communication concepts.	(5-3) The chosen scenario has an acceptable application. It demonstrates some of the wireless communication concepts.	(2-0) The chosen scenario has a simple application. It demonstrates few of the wireless communication concepts.	__/8

Selection of an appropriate Network simulator	(8-6) The network simulator chosen supports the implementation of all the concepts for the chosen scenario.	(5-3) The network simulator chosen supports the implementation of most of the concepts for the chosen scenario.	(2-0) The network simulator chosen supports the implementation of few of the concepts for the chosen scenario.	__/8
Exploration of the chosen network simulator to validate the various functionalities involved in the chosen scenario.	(8-6) The chosen simulator has been explored in depth to validate all the functionalities chosen.	(5-3) The chosen simulator has been explored to validate most of the functionalities chosen.	(2-0) The chosen simulator has been explored to validate some of the functionalities chosen.	__/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	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	30%
Apply / Analyze	50%
Create / Evaluate	20%

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester:	**7**		
Course Title:	**Introduction to Machine Learning**		
Course Code:	**23CS7OEMAL**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction:** Machine learning, Types of ML, main challenges of ML Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues. Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model.	**8**
2	**Training Models:** Linear regression, Gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression, Support Vector Machine: linear, Nonlinear.	**8**
3	**Classification:** MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification.	**8**
4	Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity or Entropy, Regularization Hyper parameters, Regression models.	**8**
5	**Ensemble learning and Random Forest:** Voting classifiers, Bagging and pasting methods, Random patches, Random forests, Boosting, stacking Dimensionality reduction: The curse of dimensionality, main approaches for dimensionality reduction, PCA.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Machine Learning	Tom M. Mitchell	1st	McGraw-Hill Education	1997
2	Hands-on Machine Learning with Scikit-Learn &TensorFlow	Aurelien Geron	2nd	O'Reilly, Shroff Publishers and Distributors Pvt. Ltd	2019

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Machine Learning	Ethem Alpaydin	2nd	PHI Learning Pvt. Ltd	2013
2	The Elements of Statistical Learning	T. Hastie, R. Tibshirani, J. H. Friedman	1st	Springer	2001
3	Machine Learning using Python	Manaranjan Pradhan, U Dinesh Kumar	1st	Wiley	2019
4	Machine Learning	Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das	1st	Pearson	2020

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	2nd	Oreilly	2019	https://readyforai.com/download/hands-on-machine-learning-with-scikit-learn-keras-and-tensorflow-2nd-edition-pdf/

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Introduction to Machine	NPTEL	2023	https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2	Machine Learning Specialization	Coursera	2023	https://www.coursera.org/specializations/machine-learning-introduction

Course Outcomes (COs):

CO1	Apply the concepts of Machine Learning
CO2	Analyse the various types of learning and its applications
CO3	Design an ML application for a given requirement

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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												

Assessment Plan for CIE:

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

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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	45%
Create / Evaluate	20%

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Semester:	**7**		
Course Title:	**Information and Network Security**		
Course Code:	**23CS7OEINS**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Information Security**: Components of information security, Balancing information security and Access, the Security systems Development Life Cycle. **Legal, Ethical and professional issues in Information Security**: Law and Ethics in Information Security, Ethics and Information Security **Planning for Security:** Information Security Planning and Governance, Information Security Policy, Standards and Practices **Risk Management**: Introduction, An Overview of Risk Management, Risk Identification, Risk Assessment, Risk Control, Quantitative Versus Qualitative Risk Management	**8**
2	**Vulnerability Analysis** Vulnerability Analysis, Penetration Testing, Layering of tests, Vulnerability Classification, Frameworks, The RISOS Study, Protection Analysis Model, Aslam's Model, Comparison and Analysis, Standards, Common Vulnerabilities and Exposures (CVE), Common Weaknesses and Exposures (CWE), Gupta and Gligor's Theory of Penetration Analysis Tool.	**8**
3	**Transport-Level Security:** Web Security Considerations Transport Layer Security, HTTPS, Secure Shell (SSH) **Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security	**8**
4	**IP Security**: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites **Intruders:** Intruders, Intrusion Detection	**8**
5	**Malicious Software:** Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation-Infected Content-Viruses, Propagation: Vulnerability Exploit, Social Engineering, Payload: System Corruption, Payload: Attack Agent, Information Theft, Stealthing, Countermeasures, Distributed Denial of Service Attacks	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Principles of Information Security	Michael E. Whitman, Herbert J. Mattord	6th	Cengage Learning	2017
2	Network Security Essentials: Applications and Standards	Williams Stallings	6th	Pearson	2017
3	Computer Security Arts and Science	Matt Bishop	2st	Addison Wesley	2019

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography: Theory and Practice	Stinson. D.	3rd	Chapman & Hall/CRC	2012
2	A Guide to Computer Network Security	Joseph Migga Kizza	2nd	Springer International Edition	2009
3	Cryptography and Network Security	Atul Kahate	3rd	Tata McGraw-Hill Publishing	2008

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Cryptography and Network Security. Principles and Practice	William Stallings	3rd	Pearson Education	2007	http://williamstallings.com/Crypto3e.html

MOOC Course:

Sl. No.	Course name	Course Offered By	Year	URL
1	Cryptography and Network Security	NPTEL	2017	http://nptel.ac.in/courses/106105031/

Course Outcomes (COs):

CO1	Apply secure communication protocols to protect data transmission
CO2	Analyze network security challenges, identify potential risks & vulnerabilities

CO-PO-PSO- Mapping:

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

Assessment Plan for CIE:

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

SEE Exam Question paper format:

Unit-1	Internal Choice	Two Questions to be asked for 20 Marks each
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	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	40%
Apply / Analyze	40%
Create / Evaluate	20%

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Semester:	**7**		
Course Title:	**Analysis and Design of Algorithms**		
Course Code:	**23CS7OEADA**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Algorithm:** Fundamentals of Algorithmic Problem Solving. **Analysis of Algorithm Efficiency:** The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithm, Mathematical Analysis of Recursive Algorithms.	8
2	**Brute-Force:** String Matching, Bubble Sort, Selection Sort. Exhaustive Search: Travelling Salesman Problem, Knapsack Problem, Assignment Problem. **Divide-and-Conquer:** Merge Sort, Quicksort, Multiplication of Large Integers, Strassen's Matrix Multiplication, Russian Peanut Multiplication.	8
3	**Decrease-and-Conquer:** Depth-First Search and Breadth-First Search, Topological Sorting, Decrease by-a-Constant-Factor Algorithms: Binary Search, Insertion Sort, Generating permutations using Johnson Trotter algorithm, Variable size decrease: Median Selection problem	8
4	**Transform-and-Conquer:** Presorting, Heap sort, Horner's rule **Greedy Technique:** 0/1 Knapsack problem, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.	8
5	**Dynamic Programming:** Binomial Co-efficient, 0/1 Knapsack Problem, Warshall's Algorithm, Floyd's Algorithm, Rod cutting Problem. **Backtracking:** *n*-Queens Problem, Subset-Sum Problem, Introduction to P, NP-Complete and NP-Hard problems.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	3rd	Pearson	2014
2	Introduction to Algorithms	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein	3rd	The MIT Press	2009

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahni, Rajasekharan	2nd	University Press Pvt. Ltd	2009
2	Analysis and design of Algorithms	Padma Reddy	1st	Sri Nandi Publications	2009

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Introduction to Design & Analysis of Algorithms	K. Raghava Rao	1st	Smash words	2013	https://www.smashwords.com/books/view/365630
2	Data structures and Algorithm Analysis in C++	Allen Weiss	4th	Pearson Education	2014	http://www.uoitc.edu.iq/images/documents/informatics-institute / competitive _ exam /DataStructures.pdf

MOOC Courses:

Sl. No	Course Name	Course Offered By	Year	URL
1	Design and Analysis of Algorithms	NPTEL	2019	https://onlinecourses.nptel.ac.in/noc19_cs47/preview
2	Design and Analysis of Algorithms	SWAYAM	2020	https://onlinecourses.swayam2.ac.in/cec20_cs03/preview

Course Outcomes (COs):

CO1	Apply various design techniques for the given problem.
CO2	Analyze time complexity of Recursive and Non-recursive algorithms using asymptotic notations.
CO3	Design algorithms for any given problem/scenario.

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												

Assessment Plan for CIE:

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

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	20%
Apply / Analyze	50%
Create / Evaluate	30%

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Semester:	**7**		
Course Title:	**Major Project Phase-2**		
Course Code:	**23CS7PWPP2**		
L-T-P:	**0-0-8**	**Total Credits:**	**8**

Guidelines:

1. Preparation of detailed design for the project (Continuation of Major Project Phase 1).
2. Implementation of the sub-modules and their integration.
3. Testing and validation.
4. Preparation and publication of implementation paper.
5. Preparation and submission of Major Project Phase 2 report.

- In-house project teams should meet their Guides weekly and update about the progress of the projects, whereas the industry project students meet their Guides once in fifteen days.
- CIE evaluation: Carried out twice in a semester by an internal panel comprising of Internal Guide and three other faculty members of the department.
- SEE evaluation: Conducted at the end of the seventh semester by both internal guide and an external examiner from other institutions.
- Evaluation is based on the demonstration of the working project by the team, project report and publication.

Note: CIE will be evaluated for 100 Marks and will be reduced to 50 Marks.

Course Outcomes (COs):

CO1	Apply the software engineering principles in planning, formulating an innovative design/ approach and computing the requirements appropriate to chosen topic within the context of legal, societal and environment constraint.
CO2	Apply the concepts of mathematics, science and engineering to implement the project and draw conclusions out of the results, while exhibiting integrity and ethical behavior in engineering practice.
CO3	Monitor, manage project schedules, resources and work assignments to ensure timely completion.
CO4	Test and defend performance of the implemented project and understand the implication of the solution.
CO5	Perform individually as well as in a team, accepting responsibility, taking initiative, and providing leadership, necessary to ensure project success.
CO6	Use formal and informal communications with team members and guide, make presentations and prepare technical document.

CO-PO-PSO mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2			2	2					2	2		
CO2	3			3	3			3						3	3
CO3											3				
CO4							1								1
CO5									1			1			
CO6										2		2			

Assessment Plan for CIE:

Tool	Remarks	Marks
Evaluation by Guide	--	50
Evaluation by Panel	--	48
Peer Evaluation	--	2
Total		100

Rubrics for Project Evaluation:

Criteria	Exemplary	Proficient	Partially Proficient	Points
Planning	(15) Project schedule: Progress, milestones and deliverables with realistic estimates of the time (Gant chart). Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	(14-6) Project schedule: Progress, milestones and deliverables (Gant chart). Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	(5-1) Project schedule: Progress, milestones and deliverables are not planned accordingly. Identify resources: (hardware and software) required to accomplish the development effort. Cost estimates of hardware and software.	__/15
Detailed Design	(15) Design is as per problem formulation. Architectural design/ System design: identifying the sub-systems. Abstract specification of the sub-systems, Interface design Carefully chosen a methodology or approach that is well-suited to the formulated problem.	(6-14) Design is as per problem formulation. Architectural design/ System design: identifying the sub-systems. Abstract specification of the sub-systems, Interface design.	(1-5) Design does not target the problem formulation optimally. Architectural design/ System design: identifying the sub-systems. Abstract specification of the sub-systems, Interface design.	__/15

Implementation	(25) Completed implementation for all set objectives as per the design and specification; justifying latest tools and techniques used. Implementation of methodology/approaches/ technique is Sustainable, innovative and is specific to the needs of the project and robust to cater to future enhancements. Showed competency in developing the system and fulfilled the objectives in the given timeline.	(24-15) Completed implementation for all set objectives as per the design and specification; justifying latest tools and techniques used. Implementation of methodology/approaches/ technique is specific to the needs of the project and robust to cater to future enhancements. Showed competency in developing the system and fulfilled the objectives in the given timeline.	(14-1) Completed implementation for all set objectives as per the design and specification; justifying latest tools and techniques used. Did not adhere to the given timeline.	__/25
Testing and Validation	(5) Data interpretation, integration, analysis and test results interpretation communicated clearly. Included high quality charts, tables, graphs, images, etc. to assist in interpreting the results and closes with a strong conclusion.	(4-3) Data interpretation, integration, analysis and test results interpretation communicated clearly. Included high quality charts, tables, graphs, images, etc. to assist in interpreting the results.	(2-1) Data interpretation, integration, analysis and test results lacks clarity.	__/5
Publication of Implementation Paper	(5) Prepared and received acceptance for Implementation Paper	(4-3) Prepared Implementation Paper	(2-1) Not Prepared Implementation Paper	__/5
Report	(15) Clear and Effective writing and adherence to appropriate report format. All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.	(14-6) Writing that is clear and effective for most part and minor errors in adherence to appropriate report format, all figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly. [6-14]	(5-1) Unclear and ineffective writing and multiple errors in adherence to appropriate report format. All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.	__/15

Oral communication	(10) Clear and effective communication. Presentation includes appropriate contents and is clearly organized. Presentation highlights key ideas and closes with a strong conclusion. Answer questions/queries professionally.	(9-6) Communication is clear. Presentation includes appropriate contents and is clearly organized. Presentation highlights key ideas. Answer questions/queries professionally.	(5-1) Unclear communication. Presentation includes appropriate contents. Presentation highlights key ideas.	__/10
Group Participation	(4) Did a full share of the work or more and volunteers to help others? Provided many good ideas; inspired others; clearly communicated ideas and needs. Completed assigned work ahead of time.	(3-2) Did almost as much work as others. Participated in discussions; on some occasions, made suggestions. Completed assigned work on time.	(1) Did less work than others. Listened mainly; Rarely spoke up, and ideas were off the mark. Needed much reminding; submission was late.	__/4
Ethics	(4) Upholds the standards of honesty and integrity. Addressed the societal and environmental issues and responsibilities.	(3) Upholds the standards of honesty and integrity. Addressed few societal and environmental issues	(2-1) Upholds the standards of honesty and integrity.	__/4
Peer Review	Peer evaluation by team members			__/2
Total				**__/100**

Note: The Project will be evaluated for 100 Marks and reduced to 50 Marks.

SEE Exam (50 Marks):

The Project work will be evaluated by an External Examiner along with the Guide.

8th Semester

BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Semester:	**8**		
Course Title:	**Network Security**		
Course Code:	**23CS8PENES**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Computer and Network Security Concepts**: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles , Attack Surfaces and Attack Trees, A Model for Network Security.	8
2	**User Authentication**: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption, Federated Identity Management, Personal Identity Verification.	8
3	**Network Access Control and Cloud Security:** Network Access Control Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control, Cloud Computing, Cloud Security Risks and Countermeasures, Data Protection in the Cloud, Cloud Security as a Service, Addressing Cloud Computing Security Concerns. **Transport-Level Security:** Web Security Considerations, Transport Layer Security, HTTPS 566, Secure Shell (SSH) 567.	8
4	**Wireless Network Security:** Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security. **Electronic Mail Security:** Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy, DNSSEC, DNS-Based Authentication of Named Entities.	8
5	**IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Cryptographic Suites. **Intruders:** Intruders, Intrusion Detection, Password Management.	8

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cryptography and network security Principles and Practices	William Stallings	7th	Pearson	2017

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Network Security: PRIVATE Communication in a PUBLIC World	Charlie Kaufman, Radia Perlman, Mike Speciner	2nd	Pearson Education	2002
2	Cryptography and Network Security	Atul Kahate	3rd	Tata McGraw-Hill	2017
3	Cryptography and Network Security	Behrouz A. Forouzan, Debdeep Mukhopadhyay	2nd	Tata McGraw- Hill	2013

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Cryptography and Network Security: Principles and Practice	William Stallings	3rd	Pearson Education	2007	http://williamstallings.com/Crypto3e.html
2	Handbook of Applied Cryptography	Menez, van Oorschot, Vanstone	1st	CRC Press	2001	http://www.cacr.math.uwaterloo.ca/hac/

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Cryptography and Network Security	NPTEL	2017	http://nptel.ac.in/courses/106105031/
2	Cryptography I	Coursera	2019	https://www.coursera.org/course/crypto

Course Outcomes (COs):

CO1	Apply secure communication protocols to protect sensitive data transmission over public networks
CO2	Analyze complex network security challenges, identify potential vulnerabilities, and formulate effective strategies for mitigating security risks
CO3	Design a comprehensive network security plan for a small to medium-sized organization, ensuring the confidentiality, integrity, and availability of data and resources

CO-PO-PSO Mapping:

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

Assessment Tool for CIE:

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

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%

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Semester:	**8**		
Course Title:	**Neural Network and Deep Learning**		
Course Code:	**23CS8PENDL**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**An Introduction to Neural Networks:** Models of a Neuron, Feedback, Network Architectures, Rosenblatt's Perceptron: The Perceptron Convergence Theorem, Relation between Perceptron and Bayes Classifier for a Gaussian Environment, The Least-Mean- Square Algorithm: Statistical LMS Learning Theory for Small Learning Rate Parameter, Learning Rate Annealing Schedules,	8
2	**Multilayer Perceptron:** Introduction, Batch Learning and on-line Learning, The Back- Propagation Algorithm, The Hessian and its Role in On-Line Learning, Generalization, Approximation of Functions, Cross-Validation, Complexity Regularization and Network Pruning, Supervised Learning viewed as an Optimization, Non-Linear Filtering	8
3	**Deep Learning: Introduction,** Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Dropout.	8
4	**Convolution neural networks:** The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms	8
5	**Sequence Modelling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Neural Networks and Learning Machines	Simon Haykin	3rd	Pearson Prentice Hall	2010
2	Deep Learning: An MIT Press Book	Ian Goodfellow, Yoshua Bengio, Aaron Courville	1st	The MIT Press	2016

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Neural Networks and Deep Learning	Charu C Aggarwal	1st	Springer International Publishing	2018
2	An introduction to neural networks	Kevin Gurney	1st	UCL Press	2004

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Deep Learning in Neural Networks: An Overview	Juergen Schmidhuber	1st	arXiv.org	2014	https://www.e-booksdirectory.com/detail.php?ebook=10110
2	Artificial Neural Network	B. Mehlig	1st	arXiv.org	2019	https://www.e-booksdirectory.com/detail.php?ebook=12212

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Neural Networks and Deep Learning	Coursera	2023	https://www.coursera.org/learn/neural-networks-deep-learning
2	Deep learning	NPTEL	2023	https://onlinecourses.nptel.ac.in/non23_ee131/preview

Course Outcomes (COs):

CO1	Apply the concepts of Neural Networks and Deep Learning for problem solving
CO2	Analyze various learning algorithms and its applications
CO3	Develop neural networks models to solve real world problems

CO-PO-PSO mapping:

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

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Assessment Plan for CIE:

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

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%
Analyze/Analyze	40%
Create / Evaluate	25%

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Semester:	**8**		
Course Title:	**Virtual & Augmented Reality**		
Course Code:	**23CS8PEVAR**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Augmented Reality:** History of AR, AR Scenarios, the future of AR, Applications of AR. Calibration and Registration: Transformations, Coordinate Systems	**8**
2	**Pose Estimation and Tracking:** Pose Estimation; Pose Tracking in AR, Mobile Sensor-Based Tracking, Optical Tracking, Hybrid Tracking, Marker-Based Tracking and AR, Diminished Reality, Marker-less Tracking and AR	**8**
3	**Computer Vision for AR:** Image Processing, Computer Vision-Definition and Scope, Object Detection and Tracking, Spatial Mapping, 3D Reconstruction for outdoor Tracking, OCR and Text Recognition for AR	**8**
4	Introduction to Virtual Reality, Interface to the Virtual World- Input, Output, Interaction.	**8**
5	Introduction to Unity, Game Objects, Models, Materials, and Textures, Terrain, Environments, Lights and Camera, Scripting.	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Augmented Reality: Theory, Design and Development	Chetankumar G Shetty	1st	McGraw Hill Publications	2020
2	Understanding Virtual Reality: Interface, Application and Design	William R Sherman, Alan B Craig	1st	Morgan Kaufmann Publishers	2002
3	Teach Yourself Unity 2018 Game Development in 24 Hours	Mike Gieg, Sams	1st	Pearson	2018

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Augmented Reality for Developers	Krystian Babilinski, Jonathan Linowes	1st	Packt	2017
2	Designing the User Interface	B. Shneiderman	4th	Addison Wesley	2014

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Augmented Reality	Jose Maria Ariso	1st	De Gruyter	2017	https://library.oapen.org/bitstream/id/f922c42d-ad74-4af1-953c-02c7518f37a7/628401.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Virtual reality	NPTEL	2014	https://nptel.ac.in/courses/106106138
2	Build 15 Augmented Reality (AR) apps with Unity & Vuforia	Udemy	2022	https://www.udemy.com/course/develop-augmented-reality-book-ar-business-card-with-unity/

Course Outcomes (COs):

CO1	Apply AR concepts to build / transform 2D/3D models
CO2	Analyse the different calibration, transformation and tracking using augmented reality
CO3	Design user event and interactive events using Unity

CO-PO-PSO Mapping:

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

Assessment Plan for CIE:

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

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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%

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Semester:	**8**		
Course Title:	**High Performance Computing**		
Course Code:	**23CS8PEHPC**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Parallel Computing**: Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques	**8**
2	**Principles of Parallel Algorithm design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for containing Interaction Overheads, Parallel Algorithms Models, Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, the Effect of Granularity on Performance	**8**
3	**Programming Using the Message Passing Paradigm:** Principles of Message Passing Programming, Building Blocks, MPI, Topologies and Embedding, Overlapping Communication with computation, Collective Communication and computation operations, Groups and Communicators	**8**
4	**Programming Shared Address Space Platforms:** Thread Basics, The POSIX Thread API, Thread Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, OpenMP: a Standard for Directive Based Parallel Programming	**8**
5	**GPU Programming using CUDA:** Heterogeneous Computing, Hello World from GPU, Introducing the CUDA Programming Model, Organizing Parallel Threads, Managing Devices, CUDA Memory Model	**8**

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Parallel Computing	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar	2nd	Pearson Education	2013

2	Professional CUDA C Programming	John Cheng, Max Grossman, Ty McKercher	1st	Wiley	2014
3	CUDA by Example, An Introduction to General Purpose GPU Programming	Jason Sanders, Edward Kandrot	1st	Addison-Wesley Professional	2010

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Advanced Computer Architecture: Parallelism, Scalability, Programmability	Kai Hwang; Naresh Jotwani	2nd	McGraw-Hill	2010

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	High Performance Computing	Charles Severance, Kevin Dowd	1st	OpenStax CNX	2009	https://archive.org/details/cnx-org-col11136 / page / n1 / mode /2up

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Introduction to High performance and parallel computing	Coursera	2022	https://www.coursera.org/learn/introduction-high-performance-computing
2	High performance computing for scientists and engineers	NPTEL	2020	https://archive.nptel.ac.in /courses/112/105/112105293/

Course Outcomes (COs):

CO1	Apply the fundamentals of high-performance computing concepts to understand the performance of HPC applications
CO2	Analyze the impact of architecture and system configurations on HPC
CO3	Demonstrate high performance computing concepts using various parallel programming paradigms

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												

Assessment Plan for CIE:

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

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	40%
Apply / Analyze	40%
Create / Evaluate	20%

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Semester:	**8**		
Course Title:	**Deep Learning**		
Course Code:	**23CS8OEDEL**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Neural Network**: The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem	8
2	**Multilayer Perceptrons:** Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Backpropagation Algorithm Perform Better, Back Propagation and Differentiation	8
3	**Regularization for Deep Learning:** Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Dropout	8
4	**Convolution neural networks:** The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms	8
5	**Sequence Modeling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Neural networks and Learning Machines	Simon Haykin	3rd	Pearson	2016
2	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	1st	MIT Press	2016

Reference Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Neural Networks and Deep Learning	Michael Nielsen	1st	Determination press	2015

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Deep Learning	NPTEL	2020	https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2	Deep learning	NPTEL	2021	https://onlinecourses.nptel.ac.in/noc21_cs76/preview
3	Deep Learning Specialization	Coursera	2023	https://www.coursera.org/specializations/deep-learning?action= enroll

Course Outcomes (COs):

CO1	Apply various types of learning and its applications
CO2	Analyse the concepts and applications of neural networks and deep learning
CO3	Design feed forward networks and convolutional neural networks for a given scenario

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												

Assessment Plan for CIE:

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

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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%

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Semester:	**8**		
Course Title:	**Cyber Security**		
Course Code:	**23CS8OECYS**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Cybercrime:** Introduction, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, Cyber-crime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.	8
2	**Cyber Offenses:** Criminals Planning Them: Introduction, planning of Attacks, Social Engineering, Cyber stalking. **Cyber Cafe and Cybercrimes, Botnets:** The Fuel for Cybercrime, Attack Vector, Cloud Computing.	8
3	**Cybercrime:** Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organisational Measures for handling mobile, Organizational security Policies and Measures in Mobile Computing Era, Laptops.	8
4	**Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks.	8
5	**Cyber Security:** Organizational Implications, Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations, Incident handling: Definitions and entities involved, incident response systems, Examples of cybersecurity Incidents and ITIL Perspective.	8

Prescribed Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives. NDIA	Nina Godbole, Sunil Belapure	1st	Wiley	2018
2	Introduction to Cyber Security Guide to the world of cyber security	Anand Shinde	1st	Notion Press	2021

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Cyber Law simplified	Vivek Sood	11th	Mc-GrawHill	2013
2	Cyber security and Cyber Laws	Alfred Basta, Nadine Basta, Mary brown, Ravindrakumar	1st	Cengage Learning	2018

E-Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	CyBOK: The Cyber Security Body of Knowledge	Awais Rashid,Howard Chivers ,George Danezis, Emil Lupu, Andrew Martin	1st	National Cyber Security Centre	2019	https://www.cybok.org/media/downloads/CyBOK-version-1.0.pdf

MOOC Courses:

Sl. No.	Course name	Course Offered By	Year	URL
1	Cyber Security and Privacy	NPTEL	2023	https://onlinecourses.nptel.ac.in /noc23_cs127/preview
2	Cybersecurity for Everyone	Coursera	2023	https://www.coursera.org/ learn/cybersecurity-for-everyone

Course Outcomes (COs):

CO1	Apply the concepts of cyber security, cyber-crime and cyber law
CO2	Analyse the prevention techniques of various cyber-attacks
CO3	Design applications to protect from cyber attacks

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**							

BMS COLLEGE OF ENGINEERING, BANGALORE-19
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Assessment Plan for CIE:

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

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%

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Semester:	**8**		
Course Title:	**Object Oriented Programming with Java**		
Course Code:	**23CS8OEOOJ**	**Total Contact Hours:**	**40**
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction of Java:** Byte code, java characteristics. Overview of Java-Object-Oriented Programming, Example programs. **Data types, Variables and Arrays**: Primitive types, Variables, Arrays. **Control statements:** Selection statements, Iteration statements, Jump statements. **Introducing classes**- Class fundamentals, Declaring objects, Introducing methods, constructors, This keyword, Garbage collection. **A Closer Look at Methods and Classes:** Overloading methods, Using objects as parameters, a closer look at argument passing, Returning objects, introducing access control, understanding static, introducing final, Arrays revisited, Command Line Arguments.	**8**
2	**Inheritance**: Inheritance basics, Using super, Multilevel hierarchy, Dynamic method dispatch, Using Abstract class, Using final with Inheritance. **Packages:** Defining a package, Finding packages and class path, Example, Access Protection, Importing Packages. **Interfaces**: Defining interface, implementing interface, Nested interfaces, Applying interfaces, Variables in interfaces, Interfaces can be extended.	**8**
3	**I/O Basics:** Streams-byte streams and character streams, predefined streams, Reading console input. Reading characters, Reading strings, Writing console output, Reading and Writing files. **String handling:** String constructors, Special string operations, Character extraction, String comparison, Searching strings, Modifying a string, String buffer, additional string buffer methods.	**8**
4	**Enumeration:** Enumeration fundamentals, value() and value of() methods, java enum's are class types. **Exception handling:** Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, nested try statements, throw, throws, finally, java's built-in exceptions. Creating your own exception subclasses. **Multithreaded Programming:** introduction to process, difference between process and threads, java thread model, main thread, creating thread, creating multiple threads, using isalive() and join(), thread priorities, synchronization.	**8**

5	**Event Handling:** two event handling mechanisms, the delegation event model, Events- event sources, event listeners. event classes-actionevent class, mouseevent class, event listener interfaces- actionlistener interface, keylistener interface, mouse listener interface, mousemotionlistener interface, using the delegation event model-some key AWT GUI concepts, handling mouse events. **Introducing Graphics**-drawing lines, rectangles, ellipses and circles, arcs, working with color.	**8**

Prescribed Text Book:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Java the Complete Reference.	Herbert Schildt	11th	Tata McGraw-hill	2019

Reference Text Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to JAVA Programming	Y. Daniel Liang	9th	Pearson Education	2012
2	Programming in JAVA 5.0	James P Cohoon, Jack W Davidson	1st	TATA McGraw-hill	2006
3	Core Java2	Cay S Horstmann, Gary Cornell	11th	Prentice Hall	2018
4	Programming with Java: A Primer	E.Balaguruswamy	5th	McGraw Hill Education	2014

E-Books:

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1	Java, Java, Java Object-Oriented Problem Solving	R. Morelli, R. Walde	3rd	Pearson Education, Inc	2012	http://www.cs.trincoll.edu/~ram/jjj/jjj-os-20170625.pdf
2	The Art and Science of Java	Eric S. Roberts	1st	Greg Tobin	2007	http://people.reed.edu/~jerry/121/materials/artsciencejava.pdf

MOOC Courses:

Sl. No.	Course name	Course offered by	Year	URL
1	Object Oriented Programming in Java	Coursera	2024	https://www.classcentral.com/course/courseraobject-oriented-programming-in-java-4212
2	Java Tutorial for Complete Beginners	Udemy	2024	https://www.udemy.com/course/java-tutorial/
3	Programming in Java	NPTEL	2024	https://swayam.gov.in/nd1_noc20_cs58/preview

Course Outcomes (COs):

CO1	Apply Java constructs for developing programs/applications
CO2	Analyse the Java construct in the given scenario
CO3	Design Java programs/ applications for a given requirement
CO4	Conduct experiments for demonstrating features of Java

CO-PO-PSO Mapping:

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

Students are supposed to execute and demonstrate java program in the lab / classroom based on the concepts taught in the theory class. The list of programs will be set by course instructor. The student has to demonstrate any two of them as given by the course instructor.

Rubrics used for evaluation:

Criteria	Excellent	Good	Unsatisfactory	Points
Design and Implementation of Program	(20-11) Able to fully design and implement program using appropriate java construct in accordance to the given problem.	(10-5) Able to moderately design and implement program using appropriate java construct in accordance to the given problem.	(4-0) Not able to design and implement program using appropriate java construct in accordance to the given problem.	__/20
Demonstration	(10-6) Demonstrates the functionality of the program with proper input and output using appropriate tools of java for all cases.	(5-3) Demonstrates the functionality of the program with proper input and output using appropriate tools of java for few cases.	(2-0) Demonstrates the functionality of the program without proper input and output using appropriate tools of java for few cases.	__/10
Viva-Voce	(10-6) Able to answer all viva questions of the java concepts.	(5-3) Able to answer few viva questions of the java concepts.	(2-0) Able to not answer viva questions of the java concepts.	__/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	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	35%
Create / Evaluate	40%

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Semester:	**8**		
Course Title:	**Internship**		
Course Code:	**23CS8SRINT**		
L-T-P:	**0-0-6**	**Total Credits:**	**6**

Guidelines:

1. Internship must be carried out in any IT organization or a premier Institute or a Research Lab or a Government organization related to Computer Science and Engineering.
2. The internship must be carried out by each student for at least four months.
3. Non-technical Internships are strictly not allowed.
4. The work carried out during the Internship will evaluated by the faculty based on three reviews during the semester.

Course Outcomes (COs):

CO1	Apply domain knowledge during the course of internship
CO2	Analyze and develop/implement the solutions using appropriate techniques, resources and contemporary tools
CO3	Work independently or collaboratively in multidisciplinary environment
CO4	Exhibit integrity and ethical behavior during the preparation of technical document/report/ development of solution
CO5	Use formal and informal communications with the guide, make presentations and prepare technical documents

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**											**2**			
CO2			**3**		**3**							**2**	**2**	**2**	**2**
CO3									**3**						
CO4								**3**							
CO5										**3**					

Assessment Plan for CIE:

Every student will be assigned a guide, who will assess their performance during the Internship phases. Three reviews will be conducted during the assessment.

Evaluation criteria for each of the reviews:

Review-1: 30 Marks

1. The student is supposed to interact with his/her guide on a regular basis.
2. The student must give a presentation on the company details, abstract of the work that is assigned to him in the organization and the domain of the project.

Review-2: 40 Marks

1. The student is supposed to interact with his/her guide on a regular basis and provide updates on the work being carried out in the organization.
2. The student must present the work carried out at the organization. The presentation must contain the details of the modules that the student has worked on.

Review-3: 30 Marks

1. The student is supposed to interact with his/her guide on a regular basis and provide updates on the work being carried out in the organization.
2. The student must present the complete work carried out at the organization along with the results and the learnings from the Internship.
3. The student must prepare and submit a report in the required format at the end of the Internship.

Rubrics for Presentation of the work carried out during the different phases of Internship:

Criteria	Excellent	Good	Average	Poor	Points
Ability to apply domain knowledge during the course of internship.	(22-16) Apply domain knowledge for design and development of all issues during the course of Internship.	(15-10) Apply domain knowledge for design and development of most issues during the course of internship.	(9-5) Apply domain knowledge for design and development of specific issues during the course of internship.	(4-1) Unable to apply complete domain knowledge for design and development issues during the course of internship.	__/22
Ability to analyze and develop/implement the solutions using appropriate techniques, resources and contemporary tools.	(28-22) Able to analyze and develop/implement all the solutions using appropriate techniques, resources and contemporary tools.	(21-15) Able to analyze and develop/implement most of the solutions using appropriate techniques, resources and contemporary tools.	(14-8) Able to analyze and develop/implement specific solutions using appropriate techniques, resources and contemporary tools.	(7-1) Not confident to analyze and develop/implement solutions using appropriate techniques, resources and contemporary tools.	__/28

Ability to work independently and in a collaboration /multi-disciplinary environment.	(16-11) Able to work independently and in a collaboration / multi-disciplinary environment.	(10-6) Able to work independently with minimal guidance and in a collaboration / multi-disciplinary environment.	(5-3) Able to work independently with more guidance and in a collaboration / multi disciplinary environment.	(2-1) Unable to work independently without guide support and in a collaboration / multi-disciplinary environment.	__/16
Ability to exhibit integrity and ethical behavior during the preparation of technical document/report/development of solution.	(14-10) Able to effectively exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of an internship report.	(9-5) Able to moderately exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of an internship report.	(4-1) Able to partially exhibit integrity and ethical behaviour while carrying out the internship and for the preparation of an internship report.	(0) Unable to exhibit integrity and ethical behavior while carrying out the internship and for the preparation of an internship report.	__/14
Ability to use formal and informal communications with the guide, make presentations and prepare technical document.	(20-16) Able to clearly communicate with guide, make effective presentations and technical document.	(15-10) Able to clearly communicate with guide, make moderate presentations and technical document.	(9-5) Able to moderately communicate with guide, make moderate presentations and technical document.	(8-1) Unable to communicate with guide, and not able to make presentations and technical document.	__/20
Total					**__/100**

Note: The Internship will be evaluated for 100 Marks and reduced to 50 Marks.

SEE Exam (50 Marks):

The work carried out during Internship will be evaluated by an External Examiner along with the Internal Examiner.