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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

IV Semester
Scheme & Syllabus of B.E. Programme
Computer Science & Engineering
(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



AICTE | NIRF NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300 | NBA | NAAC A+ | QS I-GAUGE GOLD | INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

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SCHEME OF TEACHING AND EXAMINATION – B.E. – Computer Science and Engineering

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

4th Semester

Computer Science and Engineering												
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**				
					L	**T**	**P**	**SEE Duration (Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BCS401	Design and Analysis of Algorithms	PCC	CSE	3	0	0	**3**	**50**	**50**	**100**	**3**
2	BCS402	Microcontroller and Embedded Systems	IPCC	CSE	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BCS403	Database Management Systems	IPCC	CSE	3	0	2	**3**	**50**	**50**	**100**	**4**
4	BBI404	Biology for Engineers	BSC	CHE	2	0	0	**3**	**50**	**50**	**100**	**2**
5	BCSL405	Design and Analysis of Algorithms Lab	PCCL	CSE	0	0	2	**3**	**50**	**50**	**100**	**1**
6	BCS406x	ESC/ETC/PLC	ESC	CSE	If the course is a Theory: 3	0	0	**3**	**50**	**50**	**100**	**3**
					If the course is a Laboratory: 2	0	2					
7	BUH407	Universal Human Values	UHV	ANY	1	0	0	**1**	**50**	**50**	**100**	**1**

				DEPT								
8	BXX408x	Ability Enhancement Course/Skill Enhancement Course - IV	AEC/ SEC	CSE	If the course is a Theory 1	0	0	**1** **2**	**50**	**50**	**100**	**1**
					If the course is a Laboratory 0	0	2					
9	BMP409	Metaphysical Science	HSSMC	ANY DEPT	1	0	0	**1**	**50**	**50**	**100**	**1**
10	BNS410	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	**-**	**100**	**-**	**100**	**0**
	BPE410	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO410	Yoga		Yoga Teacher								
	BMU410	Music		Music Teacher								
11	BCE411	Competency Enhancement Course-2	NCMC	CDCAC	2	0	0	-	**100**	**-**	**100**	**0**
									650	**450**	**1100**	**20**

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Engineering Science Course (ESC/ETC/PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year)

Course Code	Course Name	Course Code	Course Name
BCS406A	Discrete Mathematical Structures and Graph Theory	BCS406C	Programming with Java
BCS406B	System Software	BCS406D	Linear Algebra

Ability Enhancement Course/Skill Enhancement Course – IV

Course Code	Course Name	Course Code	Course Name
BCS408A	Green IT and Sustainability	BCS408C	Java Script and JQuery
BCS408B	Capacity Planning for IT	BCS408D	Mobile Application Development

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

National Service Scheme /Physical Education/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rd semester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Semester: IV					
Design and Analysis of Algorithms					
Course Code	**:**	BCS401	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data structures and Applications, Problem Solving through Programming, Mathematics for CSE stream.
Knowledge on Fundamental Concepts	Structures, Recursion, Memory Allocation Techniques, File Concepts, Sorting and Searching Techniques.
Knowledge on Connected Tools (If any)	GCC, Turbo C.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand methods for analysing algorithms and assessing their performance.
CLO2	Illustrate algorithm efficiency using asymptotic notations and standard growth functions.
CLO3	Apply classical algorithm design techniques such as brute force, divide and conquer, decrease and conquer, and transform and conquer to solve computational problems.
CLO4	Illustrate the principles and typical examples of greedy, dynamic programming, backtracking, and branch and bound strategies.
CLO5	Interpret the concepts of computational complexity, including P, NP, NP-complete, and NP-hard problems.

Module – 1	**08Hrs**
Introduction: What is an Algorithm? Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Text Book 1: Ch. 1 : 1.1 - 1.3, Ch. 2: 2.1 - 2.4**	
Module – 2	**08Hrs**
Brute Force and Exhaustive search: Selection Sort, Bubble sort, Brute-Force String Matching, Exhaustive Search: Travelling Salesman Problem, Knapsack Problem. **Divide and Conquer:** Merge sort, Quick sort, Binary Tree Traversal, Multiplication of Large Integers and Strassen's Matrix Multiplication. **Text Book 1: Ch. 3: 3.1-3.2, 3.4, Ch. 5: 5.1-5.4**	
Module – 3	**08Hrs**
Decrease-and-Conquer: Insertion Sort, Topological Sorting. **Transform-and-Conquer:** Balanced Search Trees, Heaps and Heapsort. **Space-Time Tradeoffs:** Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm **Text Book 1: Ch. 4: 4.1-4.2, Ch. 6: 6.3-6.4, Ch. 7: 7.1-7.2.**	
Module – 4	**08Hrs**

Dynamic Programming: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. **Text Book 1: Ch. 8: 8.1-8.2, 8.4, Ch. 9: 9.1-9.4**

Module – 5	**08Hrs**
Limitations of Algorithmic Power: Decision Trees, P, NP, and NP-Complete Problems. **Coping With Limitations of Algorithmic Power:** Backtracking: n-Queens problem, Subset-sum problem, Branch-and-Bound: Knapsack problem, Approximation algorithms for NP-Hard problems: Knapsack problem. **Text Book 1: Ch. 11: 11.2-11.3, Ch. 12: 12.1-12.3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze algorithm efficiency using asymptotic notations and classify algorithms into basic efficiency classes based on time and space complexity
CO2	Design and implement solutions to computational problems using Divide & Conquer and Decrease & Conquer strategies**.**
CO3	Develop solutions for real-world and complex computational problems by applying transform & conquer and dynamic programming techniques.
CO4	Construct graph and string processing algorithms using greedy approaches and input enhancement methods.
CO5	Differentiate between classes of computational problems (P, NP, NP-Complete) and apply advanced techniques such as backtracking, branch and bound, and approximation algorithms for efficient problem-solving.

Text Book	
1	"Introduction to the Design and Analysis of Algorithms", Anany Levitin, 3rd Edition, Pearson, (2021), ISBN13: 9780137541133.

Reference Books	
1	"Computer Algorithms/C++", Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press, ISBN13: 9788173716119.
2	"Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, PHI 4 th Edition 2022, ISBN 978-0-262-03384-8.
3	"Design and Analysis of Algorithms", S. Sridhar, Oxford (Higher Education), 2nd Edition, 2023, ISBN13: 9789354977886

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106/101/106101060/
2	https://nptel.ac.in/courses/106102064
3	https://nptel.ac.in/courses/106105164

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	1	2	1					2
CO2	3	3	3	2	2	1					2
CO3	3	3	3	2	2	1					2
CO4	3	3	3	2	3	2					2
CO5	3	3	3	2	2	2					2

Semester: IV					
Microcontroller and Embedded Systems					
Course Code	**:**	BCS402	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40+12 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Digital Electronics, Basic Electronics, Embedded Systems
Knowledge on Fundamental Concepts	Understanding of microprocessor vs. microcontroller, I/O interfacing, memory architecture
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC.
CLO2	Familiarize with ARM programming modules along with registers, CPSR and Flags.
CLO3	Develop ALP using various instructions to program the ARM controller.
CLO4	Understand the Exceptions and Interrupt handling mechanism in Microcontrollers.
CLO5	Discuss the ARM Firmware packages and Embedded System Components.

Module – 1	**08Hrs**
ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. **ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions **Textbook 1: Ch. 1:** 1.1 to 1.4, **Ch. 2:** 2.1 to 2.5	
Module – 2	**08Hrs**
Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. **Textbook 1: Ch.3:** 3.1 to 3.6	
Module – 3	**08Hrs**
C Compilers and Optimization: Basic C Data Types, C Looping Structures, Register Allocation, Function, Calls, Pointer Aliasing, Portability Issues. **Textbook 1: Ch.5:** 5.1 to 5.7, 5.13	
Module – 4	**08Hrs**
Exception and Interrupt Handling: Exception handling, ARM processor exceptions and modes, vector table, exception priorities, link register offsets, interrupts, assigning interrupts, interrupt latency, IRQ and FIQ, exceptions, basic interrupt stack design and implementation. **Firmware:** Firmware and bootloader, ARM firmware suite, Red Hat redboot, Example: sandstone, sandstone directory layout, sandstone code structure.	

Textbook 1: Ch. 9.1 and 9.2, Ch. 10

Module – 5	**08Hrs**

Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors and Actuators (LED, 7 segment LED display, stepper motor, Relay, Piezo Buzzer, Push button switch, Keyboard) Communication Interface (onboard and external types), Embedded firmware, Other system components.

Textbook 2: Ch. 1: 1.2 to 1.6, **Ch. 2:** 2.1 to 2.6

Sl.No.	**Experiments**
Module – 1	
1.	Using Keil software, observe the various Registers, Dump, CPSR, with a simple Assembly Language Programs (ALP).
Module – 2	
2.	Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program).
3.	Develop an ALP to multiply two 16-bit binary numbers.
4.	Develop an ALP to find the sum of first 10 integer numbers.
5.	Develop an ALP to find the largest/smallest number in an array of 32 numbers.
6.	Develop an ALP to count the number of ones and zeros in two consecutive memory locations.
Module – 3	
7.	Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/descending order using bubble sort.
8.	Simulate a program in C for ARM microcontroller to find factorial of a number.
9.	Simulate a program in C for ARM microcontroller to demonstrate case conversion of characters from upper to lowercase and lower to uppercase.
Module – 4 and 5	
10.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds.
11.	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall foundational concepts of ARM and embedded systems.
CO2	Elucidate the operational principles of ARM processors and the role of firmware and system components in embedded applications.
CO3	Apply ARM instruction sets and basic C programming structures to develop and debug simple embedded system applications.
CO4	Analyse the design and implementation of various ARM-based application scenarios in embedded systems.
CO5	Evaluate enhancements to embedded applications using hardware/software integration.

Text Books	
1	"system developers", Andrew N Sloss, Dominic Symes and Chris Wright, ARM guide, Elsevier, Morgan, Kaufman publishers, ISBN-10. 9781558608740, 2008.
2	"Introduction to Embedded Systems", Shibu K V, Tata McGraw Hill Education, Private Limited, 2nd Edition. ISBN-13: 978-9339219680, 2017.

Reference Books	
1	"Microcontroller (ARM) and Embedded System", Raghunandan.G.H, Cengage learning Publication, 2019, ISBN-13: 978-9353504106.
2	"Insider's Guide to the ARM7 based microcontrollers", Hitex Ltd.,1st edition, 2005, ISBN:9780954998813.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=su6AJEK5bJU&t=1781s&pp=ygUVbWljcm9jb250cm9sbGVyIG FybSA3
2	https://www.youtube.com/watch?v=6vN586Jpojk&list=PLgwJf8NK-2e7nFEozQhZDZDSm09SwqbGP
3	https://www.arm.com/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2				2			1	1		1
CO2	2				2			1	1		
CO3	3	2			2			1	1		
CO4	3	3			3			1	2		
CO5	3	3	2	1	3	1		1	2		1

Semester: IV					
Database Management Systems					
Course Code	**:**	BCS403	**Credits**	**:**	4
Hours/Week (L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs + 14 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving Through Programming, Data Structures, Discrete Mathematics, Operating Systems.
Knowledge on Fundamental Concepts	Unions, Intersections, Subsets, Propositional and predicate logic, Relations and Functions, Process Management & Concurrency.
Knowledge on Connected Tools (If any)	Oracle 11g, MySQL

Course Learning Objectives: This course will enable the students to	
CLO1	Illustrate the fundamental concepts of database systems, including the database approach, system architecture, data models, and various types of database users and environments.
CLO2	Design and model a relational database using Entity-Relationship (ER) concepts and map it to a relational schema while applying appropriate constraints and normalization techniques.
CLO3	Demonstrate the ability to write and execute SQL statements for defining schemas, manipulating data, enforcing constraints, and creating views in a relational database.
CLO4	Apply normalization techniques and functional dependency concepts to design well-structured relational schemas.
CLO5	Analyze transaction processing, concurrency control methods, and recovery techniques to ensure consistency and reliability in database systems.

Module – 1	**08Hrs**
Databases and Database Users: Introduction: An example, characteristics of the database approach, actors on the scene, workers behind the scene, advantages of using the DBMS approach, a brief history of database Applications, when Not to use a DBMS. **Database System – Concepts and Architecture:** Data models, schemas, and instances, three schema architecture and data independence, database languages and interfaces, the database system environment. **Entity-Relationship Model:** Using High-Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues. **Text Book 1: Ch. 1:** 1.1 – 1.8, **Ch. 2:** 2.1 to 2.4, **Ch. 3:** 3.1 to 3.7	
Module – 2	**08Hrs**
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary relational operations: Select ,Project, Relational Algebra Operations from Set Theory, Binary relational operations: join and division, additional relational operations (aggregate, grouping, Outer Join and Union Operations), Examples of Queries in relational algebra **Mapping Conceptual Design into a Logical Design:** Relational database design using ER to Relational Mapping	

Textbook 1: Ch. 5: 5.1-5.3 **, Ch. 8:** 8.1-8.6**, Ch. 9:**9.1	
Module – 3	**08Hrs**
Basic SQL: SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT – DELETE and UPDATE Statements in SQL, Additional features in SQL More SQL: More complex SQL retrieval queries, Specifying constraints as assertions and actions as triggers, Views in SQL, Schema Change Statements **Textbook 1: Ch. 6:** 6.1-6.5**, Ch. 7:** 7.1-7.4	
Module – 4	**08Hrs**
Basics of Functional Dependencies: Informal Design Guidelines for Relation Schemas, Functional Dependencies. **Normalization for Relational Database:** Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Further Topics in Functional Dependencies: Inference Rules, Equivalence, and Minimal Cover. **Text Book 1: Ch. 14:** 14.1 to 14.7, **Ch. 15:** 15.1	
Module – 5	**08Hrs**
Transaction Processing Concept: Introduction to transaction processing, transaction and system concepts, desirable properties of transactions, characterizing schedules based on recoverability and serializability, transaction support in SQL **Concurrency Control & Database Recovery Techniques:** Two phase locking techniques, Concurrency control based on Timestamp ordering, Recovery concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery based on deferred update and Immediate Update. **Text Book 1**: **Ch. 20:** : 20.1 to 20.6, **Ch. 21**: 21.1 – 21.2, **Ch. 22**: 22.1 to 22.3	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify and describe the fundamental concepts, architecture, and classifications of database systems.
CO2	Design relational database schemas using ER-modeling and map ER-diagrams to relational models.
CO3	Apply SQL to manage relational databases.
CO4	Apply normalization to design efficient relational schemas.
CO5	Develop reliable databases using transactions, concurrency control, and recovery.

Text Books	
1	Elmasri and Navathe," Fundamentals of Database Systems", Pearson Education, 7th Edition, 2016, ISBN-13: 978-0-13-397077-7.

Reference Books	
1	Silberschatz, Korth and Sudharshan, "Database System Concepts", McGraw-Hill 6th Edition, 2016, ISBN 0-07-352332-1
2	Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw-Hill, 3rd Edition, 2003, ISBN-10: 0072465638.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
2	https://www.youtube.com/watch?v=sEaYXwmsLw0&list=PLyqSpQzTE6M-xymXgqewlzcC3U4cdRoSu
3	https://www.w3schools.com/sql/default.asp

4	https://www.tutorialspoint.com/dbms/index.htm
5	https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/

Laboratory Programs

Instructions:

- Design, develop, and Implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.

Sl.NO	Experiments
1	Create a table called Employee & execute the following. Employee(EMPNO, ENAME, JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO, ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result. 3. Add primary key constraint and not null constraint to the employee table. 4. Insert null values to the employee table and verify the result.
2	Create a table called Employee that contain attributes EMPNO, ENAME, JOB, MGR, and SAL & execute the following. 1. Add a column commission with domain to the Employee table. 2. Insert any five records into the table. 3. Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Empno is 105.
3	Queries using aggregate functions (COUNT, AVG, MIN, MAX, SUM), Group by, Orderby. Employee(E_id, E_name, Age, Salary) 1. Create Employee table containing all Records E_id, E_name, Age and Salary. 2. Count number of employee names from employee table 3. Find the Maximum age from employee table. 4. Find the Minimum age from employee table. 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees.
4	Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary. CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)
5	Consider the schema for Company Database: EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo, DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is _Scott ‘, either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the _IoT‘project is given a 10 percent raise. 3 .Find the sum of the salaries of all employees of the _Accounts ‘department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects

	controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000.
6	Consider the schema for Student Database: Student (USN, Name, Branch, Percentage) Faculty (FID, Fname, Department, Designation, Salary) Course (CID, Cname, FID) Enroll (CID, USN, Grade) Write SQL queries to 1. Retrieve the names of all students enrolled for the course 'CS_54' 2. List all the departments having an average salary of the faculties above Rs. 10,000. 3. List the names of the students enrolled for the course 'CS_51' and having grade 'B' 4. Retrieve the names of faculty members who are handling more than one course 5. List the names of students who have enrolled in more than two courses.

CO – PO MAPPING MATRIX:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2					1				2
CO2	3	2	3		2		1				2
CO3	2	3	2		3		1				2
CO4	3	3	2	1	2	1	1			1	2
CO5	3	3	2	2	3	2	1	1	1	1	2

Semester: IV					
Biology for Engineers					
Course Code	**:**	BBI404	**Credits**	**:**	2
Hours/Week(L:T:P)	**:**	2:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	BSC	**SEE Duration**	**:**	3 Hrs

Prerequisites:	
Courses	Biology, Chemistry
Knowledge on Fundamental Concepts	-
Knowledge on Connected Tools	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental biological structures and biomolecules
CLO2	Analyze the practical applications of biomolecules in biotechnology and daily life.
CLO3	Relate human organ systems to engineered designs and solutions
CLO4	Appreciate bioinspired materials and mechanisms derived from nature
CLO5	Explore emerging trends in bioengineering and biotechnology

Module – 1	**6 Hrs**
Introduction to Biology The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each),Properties and functions), vitamins and hormones. **Textbook 1. Ch.1, Ch.2, Ch.3, Ch.4, Textbook 2. Ch. 3, Ch.4, Textbook 3. Ch. 1, Ch. 2, Ch. 3, Textbook 4. Ch.2, Ch. 3, Ch. 4**	
Module – 2	**6 Hrs**
Biomolecules and Their Applications (Qualitative) Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). **Textbook 1. Ch.5&6 Textbook 2. Ch. 4&20, Textbook 3. Ch. 5,** **Textbook 4. Ch.7& 8.**	
Module-3	**6 Hrs**
Human Organ Systems and Bio Designs (Qualitative) Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).	

Textbook 1. Ch.7-11, Textbook 2. Ch.7, 10, 13, 16 & 17 Textbook 3. Ch. 6, Textbook 4. Ch.9& 10.	
Module-4	**6 Hrs**
Nature-Bioinspired Materials and Mechanisms (Qualitative) Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and per flouro carbons (PFCs). **Textbook 1. Ch.12 &13, Textbook 2. Ch.2&3 Textbook 3. Ch. 7,** **Textbook 4. Ch.12 & 14.**	
Module-5	**6 Hrs**
Trends in Bioengineering (Qualitative) Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Selfhealing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). **Textbook 1. Ch.14 &15, Textbook 2. Ch.20 Textbook 3. Ch. 8, Textbook 4. Ch.15.**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the structure and function of cells and major biomolecules essential for life processes.
CO2	Describe the applications of biomolecules in healthcare, environment, and biotechnology.
CO3	Elucidate the human organ systems using engineering analogies and identify associated bioengineering interventions.
CO4	Illustrate nature-inspired biological mechanisms and their technological applications in engineering and material science.
CO5	Discuss emerging trends and tools in bioengineering for diagnostics, therapeutics and environmental sustainability.

Text Books	
1	**Biology for Engineers,** Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao, N Publishing, Bengaluru, 2023, ISBN-10: 9353161355
2	**Human Physiology,** Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022, ISBN-10: 1264398786
3	**Biology for Engineers,** Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012, ISBN-10: 1420077635
4	**Biology for Engineers,** Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

Reference Books	
1	**Biomedical Instrumentation**, Leslie Cromwell, Prentice Hall 2011.
2	**Biology for Engineers,** Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
3	**Biomimetics: Nature-Based Innovation**, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.

Web links and Video Lectures (e – Resources)

1	https://nptel.ac.in/courses/121106008
2	https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
3	https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
4	https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
5	https://www.coursera.org/courses?query=biology
6	https://onlinecourses.nptel.ac.in/noc19_ge31/preview
7	https://www.classcentral.com/subject/biology
8	https://www.futurelearn.com/courses/biology-basic-concepts

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3					1					1
CO2	3	2			2	3					2
CO3	3				3	2	1				2
CO4	2	2			3	2					2
CO5	2	3				3					3

Semester: IV					
Design and Analysis of Algorithms Lab					
Course Code	**:**	BCSL405	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	14Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data Structures and Applications, Problem Solving through Programming
Knowledge on Fundamental Concepts	C Programming Fundamentals and Data Structure Concepts.
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.
CLO2	Apply diverse design strategies for effective problem-solving.
CLO3	Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks.
CLO4	Understand limitations and computability of problems related to NP-Completeness and Approximation algorithm
CLO5	Compare algorithm design strategies (divide-and-conquer, greedy, dynamic programming, backtracking, graph algorithms) by developing equivalent programs and analyzing empirical results.

Experiments	
Sl. No.	**List of problems for which student should develop program and execute in the Laboratory**
1.	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2.	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3.	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
4.	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
5.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.

6.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
7.	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.
8.	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.
9.	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
10.	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
11.	Design and implement C/C++ Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.
12.	Design and implement C/C++ Program for N Queen's problem using Backtracking.

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop programs to solve computational problems using suitable algorithm design strategy.
CO2	Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).
CO3	Apply integrated development tools (IDEs) effectively to design, develop, and test programs.
CO4	Choose appropriate algorithm design techniques to develop solution to the computational and complex problems.
CO5	Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences

Web links and Video Lectures (e – Resources)	
1	Virtual Labs : http://cse01-iiith.vlabs.ac.in/

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	2	3						2
CO2	3	3	2	2	3						3
CO3	2	1	1	1	3						3
CO4	3	3	3	2	3						3
CO5	2	3	2	1	1				3	2	2

Semester: IV					
Discrete Mathematical Structures and Graph Theory					
Course Code	**:**	BCS406A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hrs

Prerequisites:	
Courses	Engineering Mathematics, Set Theory
Knowledge on Fundamental Concepts	Understanding of logic, sets, relations, functions, counting principles, and basic proof techniques
Knowledge on Connected Tools (If any)	Mathematical software like Wolfram Alpha, MATLAB, or LaTeX

Course Learning Objectives: This course will enable the students to	
CLO1	Understand logical statements using truth tables, rules of inference, and quantifiers to construct valid logical arguments
CLO2	Explore Fundamental principles of counting, permutations, combinations, recurrence relations, and generating functions to solve combinatorial problems.
CLO3	Comprehend properties of relations and functions, including equivalence relations, partial orders, Stirling numbers, and function growth analysis.
CLO4	Apply the foundational concepts of group theory to solve problems in coding theory using the Hamming metric and matrix representations.
CLO5	Analyze various graph and tree structures, including their properties, representations, and applications in sorting and spanning tree algorithms

Module – 1	**08Hrs**
Fundamentals of Logic Basic Connectives and Truth Tables, Tautologies, Logical Equivalence: The laws of logic, Logical Implications, Rules of inference. Open Statement, Quantifiers, Definition and the use of Quantifiers, Definitions, and the proofs of theorems. **Text Book 1: Ch. 2:** 2.1-2.5	
Module – 2	**08Hrs**
Fundamental Principles of Counting and Combinatorics The Rule of Sum and Product, Permutations, Combinations, Principle of Inclusion and Exclusion, Derangements, The Binomial Theorem, Combinations with repetition. **Recursive Definitions, Recurrence Relations** Recursive definition, First order linear recurrence relation- Formulation problems and examples, Second order linear recurrence relations with constant coefficients- Homogeneous and Non homogeneous, Generating functions. **Text Book 1: Ch. 1:** 1.1 - 1.4, **Ch. 10:** 10.1 - 10.3, **Ch. 8:** 8.3	
Module – 3	**08Hrs**
Relations Properties of relations, Composition of Relations, Partial Orders, Hasse Diagrams, Equivalence Relations, and Partitions. **Functions** Functions-plain, One-to-one, onto functions, Stirling numbers of the second kind, Function composition and Inverse function, Growth of function.	

Text Book 1: Ch. 5: 5.1 - 5.3, **Ch. 7:** 7.1 - 7.4	
Module – 4	**08Hrs**
Groups theory: Definition, Examples and Elementary properties, Abelian groups, Homomorphism isomorphism, cyclic groups, cosets and Lagrange's theorem. **Coding Theory:** Elementary coding theory, the hamming metric, the parity-Check and Generator Matrices **Text Book 1: Ch.15:** 15.1 - 15.5, 15.7 - 15.9, 15.11	
Module – 5	**08Hrs**
Introduction to Graph Theory: Graphs and their basic properties - degree, path, cycle, complement, subgraphs, isomorphism, Computer representations of graphs. Eulerian and Hamiltonian graphs, Graph coloring, Planar graphs. **Trees:** Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Spanning trees. **Text Book 1: Ch.11:** 11.1 - 11.6**, Ch. 12:** 12.1 - 12.3	

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the foundational concepts of logic, combinatorics, relations, and functions.
CO2	Apply counting techniques, recurrence relations, and function properties to solve computational problems.
CO3	Analyze complex problem scenarios and construct solutions using logical inference, graph theory, and algebraic structures.
CO4	Develop innovative approaches using discrete structures like graphs, groups, and recurrence relations.
CO5	Utilize the fundamental properties of graphs and trees to solve problems related to connectivity, traversal, and optimization.

Text Book	
1	"Discrete and Combinatorial Mathematics- An Applied Introduction",Ralph P. Grimaldi and B V Ramana, 5th Edition, Pearson Education, Asia,— 2017, ISBN 978-0321385024

Reference Books	
1	"Introduction to Graph Theory",Garry Chartand and Ping Zhang, Tata McGraw-Hill, 2006, 978-0070616080.
2	"Discrete Mathematical Structures Theory and Applications",D.S. Malik and M.K. Sen Latest Edition, Thomson, 2004, 978-0619212858.
3	"Discrete Mathematics and its Applications", Kenneth H. Rosen, Tata — McGraw Hill, 6 Edition, 7th edition 2017, ISBN-(13): 978-0070681880
2	"Discrete and Combinatorial Mathematics", Ralph P. Grimaldi: 5th Edition, Pearson Education. 2004, 978-0-201-72634-3.
3	"Graph theory with the applications to engineering & Computer Science",Narsingh Deo, Dovers Publications, 2016, 978-0486807935.

Web Links	
1	https://www.youtube.com/playlist?list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS
2	https://www.youtube.com/playlist?list=PLl-gb0E4MII0sGLCJeqDB3y63HZ6lM5LJ
3	https://discrete.openmathbooks.org/dmoi4.html

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1						1	
CO2	3	3	2	2						1	
CO3	3	2	3	2					1	1	
CO4	3	2	3	3					1	1	
CO5									2	2	2

Semester: IV					
System Software					
Course Code	**:**	BCS406B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Operating System, Digital Design and Computer Organization, Micro Controller and Embedded Systems.
Knowledge on Fundamental Concepts	Instruction formats, addressing modes, CPU architecture, memory management**.**
Knowledge on Connected Tools (If any)	GCC

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the underlying principles of System Architecture and their machine interactions with the assemblers.
CLO2	Apply data structures and algorithms in the development of assemblers.
CLO3	Understand the basic loader and macro processor functions.
CLO4	Analyze the design and implementation techniques used in the development of system software components.
CLO5	Explore the functioning of system software tools and their role in program execution and optimization.

Module – 1	**08Hrs**

Machine Architecture: Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture.
Assemblers-1: Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

Test Book 1: **Ch-1**: 1.1-1.3.2, **Ch-2**: 2.1, 2.2

Module – 2	**08Hrs**

Assemblers -2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Program Linking, Assembler Design Operations - One- Pass Assembler, Multi-Pass Assembler.

Test Book 1: **Ch-2:** 2.3, 2.4

Module – 3	**08Hrs**

Loaders and Linkers: Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader.
Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine- Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters.

Test Book 1: **Ch-3:** 3.1, 3.2, **Ch-4:** 4.1, 4.2

Module – 4	**08Hrs**
LEX and YACC – 1: Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Using LEX – Regular Expression, Examples of Regular Expressions, A Word Counting Program, Parsing a Command Line. **Test Book 2:** Ch-1, Ch-2.	
Module – 5	**08Hrs**
LEX and YACC - 2: Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens. **Test Book 2**: Ch-3.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the structure, functions, and purpose of different types of machine architecture.
CO2	Demonstrate the functionalities of an assembler.
CO3	Illustrate the working of loaders, linkers and macro processors with relevant examples.
CO4	Design and implement lexical analyzers to tokenize source code using tools and techniques such as regular expressions.
CO5	Develop parsers for simple programming languages using context-free grammars.

Text Books	
1	"System Software: An Introduction of System Programming", Leland. L. Beck and D Manjula 3rd edition, 2012, ISBN 978-0201423006.
2	"LEX and YACC", 2nd edition, O'Reilly,John R Levine, Tony Mason and Doug Brown SPD, 1998, ISBN: 9781565920002.

Reference Books	
1	"Systems programming", Srimanta Pal, Oxford university press, 2016
2	"System programming and Compiler Design", K C Louden, Cengage Learning
3	"System software and operating system", D. M. Dhamdhere, TMG

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106105214
2	https://nptel.ac.in/courses/106106144

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2									1
CO2	2	2	2								1
CO3	2	2	1								1
CO4	2	2	2		2		1				1
CO5	2	2	2		2		1				1

Semester: IV					
Programming with Java					
Course Code	**:**	BCS406C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	2:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	30+14 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through Programming.
Knowledge on Fundamental Concepts	Basic understanding of programming logic, data types, control structures, operators and functions.
Knowledge on Connected Tools (If any)	Eclipse.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand object-oriented principles and basic Java constructs such as classes, objects, data types, methods, and control structures.
CLO2	Use the concepts of inheritance and interfaces to achieve code reusability and polymorphism in Java programs.
CLO3	Develop modular Java programs using packages and handle runtime errors using appropriate exception handling techniques.
CLO4	Implement concepts of multithreading and Swings program development.
CLO5	Implement database application in Java using JDBC.

Module – 1	**06Hrs**
Introduction to Java: Object oriented programming (Two Paradigms, Abstraction, and The Three OOP Principles), Using Blocks of Code, The Bytecode, The Java Buzzwords, and Structure of a Java Program, Data types, variables, operators, control statements and Arrays. **Introducing classes:** Class fundamentals, declaring objects, assigning object reference variables, Introducing methods, Constructors, this keyword, Garbage Collection,. **Methods and classes:** Overloading methods, Objects as parameters, argument passing, Returning objects, Recursion, Access Control, Understanding static, Introducing final, Introducing Nested and Inner Classes. **Text Book 1: Ch.1.4, Ch.1.8, Ch.2, Ch.3, Ch.4, Ch.5, Ch.6, Ch.7**	
Module – 2	**06Hrs**
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class. **Interfaces:** Interfaces, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Text Book 1: Ch.8, Ch.9.4 - 9.7**	
Module – 3	**06Hrs**

Packages: Packages, Packages and Member Access, Importing Packages. **Exceptions:** 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, Chained Exceptions. **Text Book 1: Ch.9:** 9.1-9.3**, Ch.10:** 1-10.12

Module – 4	**06Hrs**
Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State. **Introducing Swing:** The Origin of Swing, Swing Is Built on AWT, Two Key Swing Features, The MVC Connection, Components and Containers, The Swing Packages, A Simple Swing Application. **Text Book 1: Ch.11: 11.1 - 11.10, Ch. 32: 32.1-32.7**	

Module – 5	**06Hrs**
JDBC Objects: The concept of JDBC, JDBC Driver Types, JDBC packages, A brief overview of the JDBC Process, Database Connection, Associating the JDBC/ODBC Bridge with the Database, Statement Objects, ResultSet, Transaction Processing, Metadata, Data Types, Exceptions. **Text Book 2: Ch. 6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the core object-oriented programming principles in Java through the use of classes, objects, methods, and arrays.
CO2	Illustrate how inheritance and packages can be applied to solve real-world problems.
CO3	Apply the concept of interfaces and exception handling to address complex real-world problems.
CO4	Develop Java applications using multi-threaded programming and Swings.
CO5	Apply JDBC to build database applications.

Text Books	
1	Java: "The Complete Reference", Herbert Schildt, 13th Edition, 2024, McGraw-Hill, ISBN: 9781265058432
2	J2EE – "The Complete Reference "– Jim Keogh, 1st Edition, 2017, Tata McGraw Hill, ISBN: 978-0070529120

Reference Books	
1	"Programming with Java", E Balagurusamy, 6th Edition, Mar-2019, McGraw Hill Education, ISBN: 9789353162337.
2	"Thinking in Java, Bruce Eckel", Fourth Edition, 2006 , Prentice Hall, (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)
3	Introduction to Java Programming, Y. Daniel Liang, 6th Edition, 2007, Pearson Education.

Web links and Video Lectures (e – Resources)	
1	Java Tutorial: https://www.geeksforgeeks.org/java/
2	Introduction To Programming In Java (by Evan Jones, Adam Marcus and Eugene Wu): https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/
3	Java Tutorial: https://www.w3schools.com/java/

4	Java Tutorial: https://www.javatpoint.com/java-tutorial
5	Programming in Java: https://onlinecourses.nptel.ac.in/noc20_cs58/preview

Practical Components:

Sl.NO	Experiments
1.	Create a class namely Account with the data members (Accno : integer, name :String, Phone No: integer, balance_amt:float), and following methods : a. CreateAccount() method to create an account. b. Deposit() method to deposit amount to an account. c. Withdraw() method which gets the amount to be withdrawn from his/her account. d. PrintAccount() method to display account details.
2.	Write a Java Program that does the following related to Inheritance: a) Create an abstract class called Vehicle which contains the 'year of manufacture' data member and two abstract methods getdata() and putdata() with a constructor. b) Create two derived classes 'Two-wheeler' and 'Four-wheeler' and implement the abstract methods. Make 'Four-wheeler' as final class. c) Create class 'MyTwoWheeler' which is a subclass of 'Two-wheeler' and demonstrate the use of super keyword to initialize data members of 'MyTwoWheeler'.
3.	Write a JAVA program to create an interface Resizable with methods resize Width (int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods
4.	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.
5.	Write a JAVA program to read two integers a and b. Compute a/b and print, when b is not zero.Raise an exception when b is equal to zero. Also demonstrate working of ArrayIndexOutOfBound-Exception
6.	Write a java program that implements a multi-thread application that has two threads. one thread displaying "SJC Institute of Technology" once every ten seconds and another displaying "ISE" once every two seconds.
7.	Demonstrate a swing event handling application that creates 2 buttons Alpha and Beta and displays the text "Alpha pressed" when alpha button is clicked and "Beta pressed" when beta button is clicked.
8.	Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries(For example update, delete, search etc…).

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									1
CO2	3	3	2								1
CO3	3	3	2	2	3						1
CO4	3	3	2	2	3						2
CO5	3	2	2	2	2				1		1

Semester: IV					
Linear Algebra					
Course Code	**:**	BCS406D	**Credits**	**:**	3
Hours/Week(L:T:P:S)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Engineering Mathematics
Knowledge on Fundamental Concepts	Understanding of vectors, matrices, systems of linear equations, vector spaces, and matrix operations
Knowledge on Connected Tools (If any)	MATLAB, Octave for matrix calculations and visualization

Course Learning Objectives: This course will enable the students to	
CLO1	Define the fundamental properties of vector spaces, subspaces, and linear dependence concepts.
CLO2	Interpret linear transformations and their matrix representations including kernel and image.
CLO3	Apply concepts of eigenvalues, eigenvectors, and the Cayley-Hamilton theorem to solve matrix-related problems.
CLO4	Construct orthogonal bases and solve least square problems using inner product space techniques.
CLO5	Analyze and implement optimization techniques using diagonalization, SVD, and PCA.

Module – 1	**08Hrs**
Vector Spaces: Introduction, Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates. **Text Book 1: Ch. 4:** 4.1 - 4.5	
Module – 2	**08Hrs**
Linear Transformations: Introduction, Linear Mappings, Geometric linear transformation of i2, Kernel and Image of a linear transformations, Rank-Nullity Theorem (No proof), Matrix representation of linear transformations, Singular and Non-singular linear transformations, Invertible linear transformations. **Text Book 1: Ch. 1**	
Module – 3	**08Hrs**
Eigenvalues and Eigenvectors: Introduction, Polynomials of Matrices, Applications of Cayley-Hamilton Theorem, Eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form. **Text Book 1: Ch. 5:** 5.1 - 5.4	
Module – 4	**08Hrs**

Inner Product Spaces: Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error. **Text Book 1: Ch. 6**	
Module – 5	**08Hrs**
Optimization Techniques in Linear Algebra: Diagonalization and Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Hessian Matrix, Method of steepest descent, Singular value decomposition. Dimensionality reduction — Principal component analysis. **Text Book 1: Ch. 5:** 5.3, **Ch. 7**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the structure of vector spaces and determine the basis and dimension of subspaces.
CO2	Illustrate the effect of linear mappings and examine their invertibility through transformation matrices.
CO3	Analyze problems involving eigenvalues, minimal polynomials, and Jordan canonical forms.
CO4	Use the Gram-Schmidt process and QR factorization in projection and approximation contexts.
CO5	Evaluate quadratic forms and use SVD and PCA for optimization and dimensionality reduction in real-world applications.

Text Book	
1	"Linear Algebra and its applications", David C. Lay, Steven R. Lay, Judi J Mc. Donald: 6th Edition, Pearson Education, 2021, 978-0-13-585125-8.

Reference Books	
1	"Linear Algebra: An Introduction", Richard Bronson & Gabriel B. Costa2nd edition. Academic Press, 2014, 978-0120887842.
2	"Theory and problems of linear algebra", Seymour Lipschutz, Marc Lipso: 6th edition, McGraw-Hill Education, 2017, 978-1260011449 .
3	"Linear Algebra and its applications",Gilbert Strang, 4th edition, Brooks Cole, 2005, 978-0-03-010567-8.

Web links and Video Lectures (e – Resources)	
1	https://ocw.mit.edu/courses /mathematics/18-06sc-linear-algebra-fall 2011/ index.html
2	https://www.math.ucdavis.edu/ linear/linear.pdf
3	https://www.coursera.org/learn/linear-algebra-machine-learning
4	https://nptel.ac.in/syllabus/111106051/
5	http://nptel.ac.in/courses.php?disciplineID=111
6	http://www.class-central.com/subject/math(MOOCs)
7	http://academicearth.org/
8	VTU e-Shikshana Program
9	VTU EDUSAT Program.

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2										1
CO2	3	2									1
CO3	3	2	2	1							1
CO4	3	2		1							1
CO5	3	2		1							1

Semester: IV					
Universal Human Values (UHV)					
Course Code	**:**	BUH408	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	15 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	UHV	**SEE Duration**	**:**	1 Hr.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the need, purpose, and content of value-based education.
CLO2	Facilitate self-exploration as a process to understand human aspirations and their fulfillment.
CLO3	Understand harmony at various levels – individual, family, society, nature, and existence.
CLO4	Promote ethical competence and awareness of professional ethics.
CLO5	Encourage the adoption of a holistic and humanistic approach in personal and professional life.

Module-1	**03 Hrs**
Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations. **Textbook1- Ch.1&2**	
Module-2	**03 Hrs**
Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health. **Textbook1- Ch.3**	
Module-3	**03 Hrs**
Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. **Textbook1- Ch.4&5**	
Module-4	**03 Hrs**
Harmony in the Nature/Existence Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels and The Holistic Perception of Harmony in Existence. **Textbook1- Ch.6&7**	
Module-5	**03 Hrs**

Implications of the Holistic Understanding – a Look at Professional Ethics
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession
Textbook1- Ch.8&9

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the need and importance of value education and the process of self-exploration.
CO2	Explain the concept of harmony in the human being, differentiating the needs of the self and the body.
CO3	Apply the principles of trust, respect, and justice to improve relationships within the family and society.
CO4	Analyze and appreciate the interconnectedness and mutual fulfillment among the four orders of nature.
CO5	Demonstrate ethical behavior and decision-making in professional and personal contexts by integrating human values.

Text Books	
1	The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2	The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e – Resources)

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1					2	3	2	2		2
CO2	2	2				2	3		1		2
CO3						3	3	3	2		2
CO4						2	2		1		2
CO5						3	3	2	2		3

Semester: IV					
Green IT and Sustainability					
Course Code	**:**	BCS408A	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	15 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	AEC/SEC	**SEE Duration**	**:**	1 Hours

Prerequisites:	
Courses	Principles of c Programming
Knowledge on Fundamental Concepts	Computer Organization
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Classify the challenges for Green ICT
CLO2	Relate the environmental impact due to emerging technologies.
CLO3	Demonstrate different aspects of ICT metrics
CLO4	Compare the various parameters related to Sustainable Cloud Computing
CLO5	Interpret the effects of software design on the sustainability

Module – 1	**08Hrs**
Green ICT -History, Agenda, and Challenges Ahead: Introduction, Industrial Revolution, The Emergence of Information and Communication Technologies, The Agenda and Challenges Ahead.	
Module – 2	**08Hrs**
Emerging Technologies and Their Environmental Impact: Introduction, Number of Connected Devices, Increased, Functionality, Increased Number of Separate Functions, Increased Demand for Speed and Reliability, Obsolescence—The Problem of Backward Compatibility, The Other Side of the Balance Sheet, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Intelligent Energy Metering, Building Management Systems, Saving IT	
Module – 3	**08Hrs**
Measurements and Sustainability: Introduction, ICT Technical Measures, Ecological Measures and Ethical Consideration, Systems Engineering for Designing Sustainable ICT-Based Architectures.	
Module – 4	**08Hrs**
Sustainable Cloud Computing: Introduction, Challenges in the Use of Cloud Computing As Green Technology, Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications.	
Module – 5	**08Hrs**
Sustainable Software Design: Overview and Scope, Evaluating Sustainability Effects , Sustainability and the Product Life Cycle , Direct Effects: Sustainability During Use, Runtime Energy Consumption Basics , Analysing the Energy Consumption of an Application , Energy Consumption Reduction Using Physical Properties of Semiconductors, Optimizing the Energy Consumption of an Application: Compiler Techniques, Optimizing the Energy Consumption of an Application: Runtime Approaches.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the Green IT and environmental impact of traditional IT practices.
CO2	Apply the concepts of green hardware and software methodologies.
CO3	Illustrate the dimensions of sustainability development
CO4	Analyze the strategies for implementing Green IT and sustainability initiatives
CO5	Identify sustainable computing technologies and practices

Text Books	
1	"The Greening of IT",John Lamb, Pearson Education, 2009, ISBN 10: 0137150830
2	"Green Computing and Green IT- Best Practices on regulations & industry", Jason Harris, Lulu.com, 2008, ISBN: 1558604898

Reference Books	
1	"Information Technology for Environmental Sustainability" Greening through IT: by Bill Tomlinson 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830
2	"Harnessing Green IT Principles and Practices", San Murugesan, G.R. Gangadharan, Wiley Publication, 2012. ISBN:9788126539680

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=kvn_-mJ2tSo
2	https://www.brightest.io/sustainability-measurement

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2						1				1
CO2	2	1					1				1
CO3	2	2	1	1	2		1				1
CO4	1	1	1	2			1				2
CO5	1	1	1	1	2		1				1

Semester: IV					
Capacity Planning for IT					
Course Code	**:**	BCS408B	**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	15 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	1 Hours

Prerequisites:	
Courses	Computer Networks, Operating System
Knowledge on Fundamental Concepts	Understanding of resource allocation, workload forecasting, performance metrics, and scalability principles
Knowledge on Connected Tools (If any)	Nagios, SolarWinds, or cloud platform dashboards

Course Learning Objectives: This course will enable the students to	
CLO1	Comprehend the fundamental goals, metrics and issues in capacity planning and monitoring.
CLO2	Illustrate how measurement data supports capacity prediction and planning.
CLO3	Use principles of automated deployment, installation, and configuration in IT systems.
CLO4	Analyze Role of virtualization and cloud services in capacity planning.
CLO5	Apply virtualization and cloud computing concepts to evaluate resource usage and cost through real-world use cases

Module – 1	**03Hrs**
Goals, Issues, and Processes: capacity planning, Quick and Dirty Math, Predicting When Your Systems Will Fail, Make Your System Stats Tell Stories, Buying Stuff: Procurement Is a Process, Performance and Capacity: Two Different Animals, The Effects of Social Websites and Open AP!s. **Setting Goals for Capacity:** Different Kinds of Requirements and Measurements, Architecture Decisions. **Text Book 1: Ch. 1, Ch. 2:** 2.1, 2.6	
Module – 2	**03Hrs**
Measurement: Units of Capacity: Aspects of Capacity Tracking Tools, Applications of Monitoring. **Text Book 1: Ch. 3:** 3.1, 3.10	
Module – 3	**03Hrs**
Measurement: API Usage and Its Effect on Capacity, Examples and Reality. **Predicting Trends:** Riding Your Waves. **Text Book 1: Ch. 3:** 3.17, 3.18; **Ch. 4:** 4.1	
Module – 4	**03Hrs**
Predicting Trends: Procurement, The Effects of Increasing Capacity, Long-Term Trends, Iteration and Calibration. **Deployment:** Automated Deployment Philosophies, Automated Installation Tools, Automated Configuration. **Text Book 1: Ch. 4:** 4.8, 4.11, 4.12, 4.15; **Ch. 5:** 5.1, 5.2, 5.3	
Module – 5	**03Hrs**

Virtualization and Cloud Computing: Virtualization, Cloud Computing, Computing Resource Evolutions, Mixed Definitions, Cloud Capacity, Use it or lose it (your wallet),Measuring the clouds, Cloud Case Studies, Cloud Use Case: Anonymous Desktop Software Company. **Text Book 1: Ch. 6**

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall key concepts, goals, and issues related to capacity planning and system performance.
CO2	Explain various capacity measurement techniques and tools used for tracking and monitoring system performance.
CO3	Explore measurement data for prediction towards overall planning process.
CO4	Analyze deployment and configuration approaches for efficient system management.
CO5	Apply virtualization and cloud solutions for designing scalable and cost-effective capacity plans.

Text Book	
1	"The Art of Capacity Planning", John Allspaw, 2 nd Edition, O'Reilly, 2008, 978-0-596-51857-8

Reference Books	
1	"Web Operations: Keeping the Data On Time", John Allspaw and Jesse Robbins1st Edition, O'Reilly Media, 2010, 978-0-596-80264-2
2	"Cloud Computing: Concepts, Technology & Architecture", Thomas Erl, 1st Edition, 2013, 978-0-13-338752-0

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=w0cD26CLBAO
2	https://www.youtube.com/watch?v=S-hhfBXykec
3	https://www.youtube.com/watch?v=9e4IohiFmZ8&t=63s
4	https:/ /www.youtube.com/watch?v=qj4ziswxupE
5	https://www.youtube.com/watch?v=jTW79ofC6Go
6	https://www.youtube.com/watch?v=_pPlanXSwQY

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2		2								1
CO2	2	2	2	2							1
CO3	2	3	2	2							1
CO4	2	2	2	2	2	1		1	2		1
CO5	3		2	2	2	1		1	1	2	1

Semester: IV					
Java Script and JQuery					
Course Code	**:**	BCS408C	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	12-15 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Object Oriented Programming with JAVA
Knowledge on Fundamental Concepts	Variables, Functions, Control Structures, HTML and CSS
Knowledge on Connected Tools (If any)	Visual Studio Code (VS Code)

Course Learning Objectives: This course will enable the students to	
CLO1	Understand primitives of JavaScript Programming.
CLO2	Implement arrays and objects in JavaScript to create structured and functional programs.
CLO3	Make Use of basic jQuery methods to access and manipulate HTML elements in web pages.
CLO4	Demonstrate jQuery methods to manipulate HTML elements and handling events.
CLO5	Apply JavaScript and jQuery techniques to build interactive web applications with form handling, animations, and dynamic styling.

Sl.NO	**Experiments**
1.	a. Develop a JavaScript program to Capitalize the first letter of each Word of a sentence (String). b. Develop a JavaScript program to Check a string starts with 'Java'.
2.	a. Develop a JavaScript program to display the current day and time. b. Develop a JavaScript program to reverse a given string
3.	a. Develop a JavaScript program to display a message using alert. b. Develop a JavaScript program to display a confirm message on a button click. c. Develop a JavaScript program to read value through prompt window and display the value on a button click.
4.	a. Develop a JavaScript program to display (on respective button clicks) multiplication and division of two numbers. Read values from the textboxes and design two buttons (use DOM). b. Develop a JavaScript program to highlight with red color the HTML links () having class name “high” (use DOM).
5.	a. Develop a JavaScript program to read the content of HTML paragraph and update (on button click event) with the suitable Text read from the HTML Textbox (Use innerHTML) b. Develop a JavaScript program to check for an attribute (‘href’ in) and get its value/display on the Web page on a button click.
6.	a. Develop a JavaScript program to sort a list of numbers (Use arrays and functions) b. Develop a JavaScript program to create a hotel object using object literal syntax having properties (name, location, room rate, discount etc), constructors and method (offer-price). Create few objects to demonstrate the access of properties and an associated method.
7.	a. Develop a jQuery program to disable/enable the form and disable right click menu. b. Develop a jQuery program to Underline all the words and first word bold.

8.	a. Develop a jQuery program to Add options to a drop-down list. b. Develop a jQuery program to Change the button text.
9.	a. Develop a jQuery program to Disable a link. b. Develop a jQuery program to Delete all table rows except first one.
10.	a. Develop a jQuery program to Change a CSS class. b. Develop a jQuery program to Set the background color.
11.	a. Develop a jQuery program to Add two classes. b. Develop a jQuery program to Add a specified class.
12.	a. Develop a jQuery program to read and display the value entered in a Textbox and option chosen in dropdown list with relevant events. b. Develop a jQuery program to Animate paragraph element.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply fundamental concepts of JavaScript to develop simple programs.
CO2	Design programs to handle structured data (object) and data items (array).
CO3	Develop programs to access and manipulate HTML with DOM and event handling.
CO4	Demonstrate the role of jQuery selectors to access HTML elements of Web pages.
CO5	Implement jQuery methods to manipulate HTML and trigger events in Web pages.

Text Book	
1	"Interactive Front-End Web Development", Javascript and jQuery: Jon Duckett,1st Edition, 2014, Willey, ISBN-13: 978-1118871652.

Reference Books	
1	"Learning Web Design: A Beginners Guide to HTML, CSS, JavaScript, and Web Graphics",Jennifer Robbins , 5th Edition, 2018, O'Reilly Media, ISBN-13: 978-1491960202
2	"JavaScript: The Definitive Guide, David Flanagan", 7th Edition, 2020, O'Reilly Media,ISBN-13 978-14 91952023.
3	"JavaScript: The Good Parts ,Douglas Crockford", 1st Edition, 2008, O'Reilly Media, ISBN-13: 978-0596517748.

Web links and Video Lectures (e – Resources)	
1	https://www.w3schools.com/js/
2	https://www.javascript.com/learn/

CO – PO MAPPING

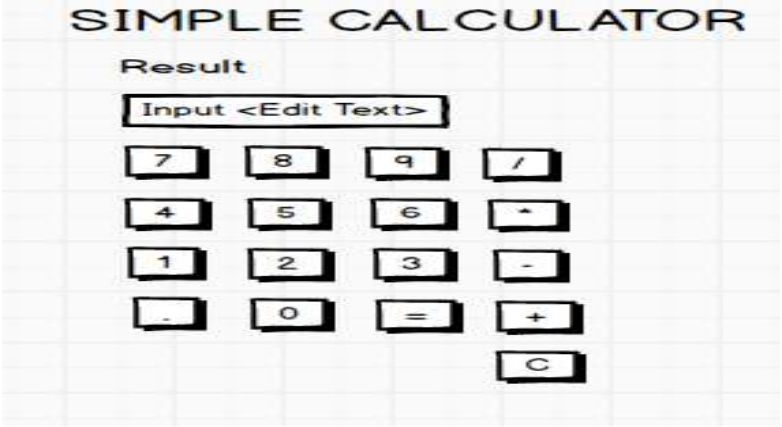
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	1	1	2		1				2
CO2	3	2	2	2	2		1		1		2
CO3	3	2	2	2	2		1		1		2
CO4	3	2	2	2	2		1	1	1		2
CO5	3	2	2	2	2		1		1		2

Semester: IV					
Mobile Application Development					
Course Code	**:**	BCS408D	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	14 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	02 Hours

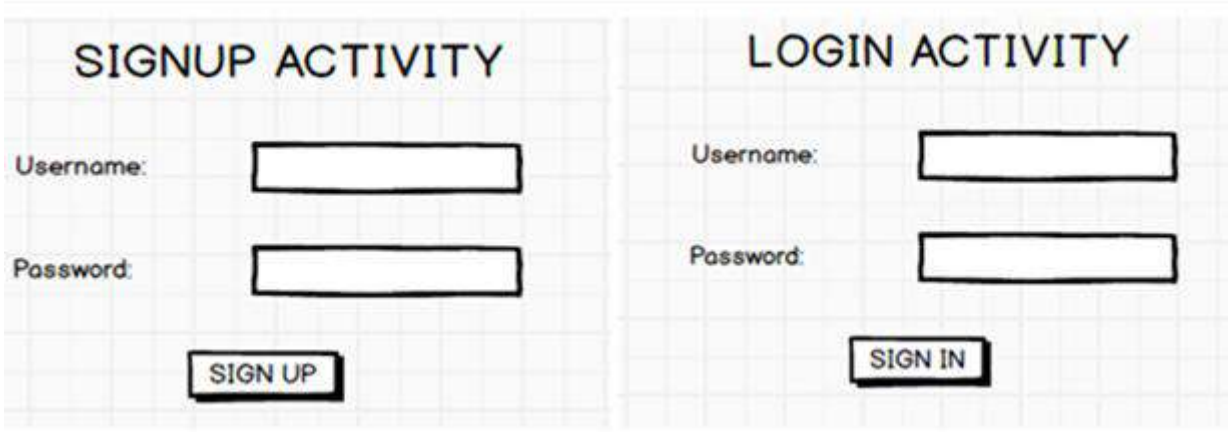
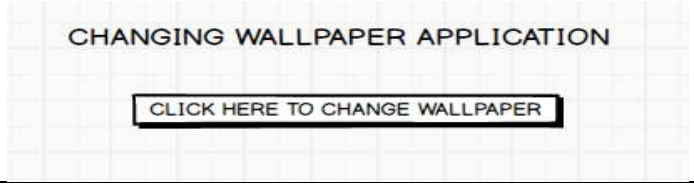
Prerequisites:	
Courses	Problem Solving Through Programming, Web Application Development with HTML and PHP, Object-Oriented Programming With Java, DBMS
Knowledge on Fundamental Concepts	Fundamental concepts of XML & DBMS , CSS, JavaScript, forms, Frames
Knowledge on Connected Tools (If any)	Android Studio, Xcode, emulators, Git.

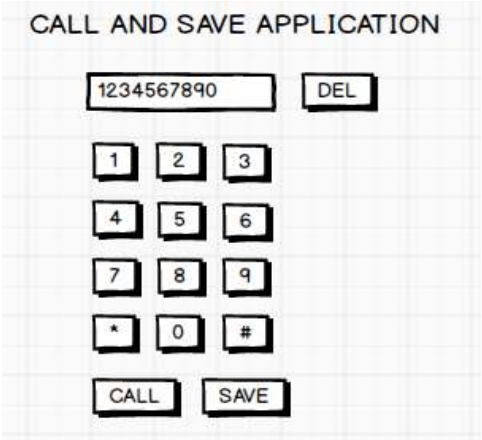
Course Learning Objectives: This course will enable the students to	
CLO1	Describe the core concepts of Android programming and the Android application lifecycle.
CLO2	Set up and configure Android Studio to develop and run basic Android applications.
CLO3	Design and implement interactive user interfaces using Android's UI components and layouts.
CLO4	Construct and manipulate SQLite databases to store, retrieve, and update application data.
CLO5	Analyze and integrate Android components such as services and content providers for data sharing and communication.

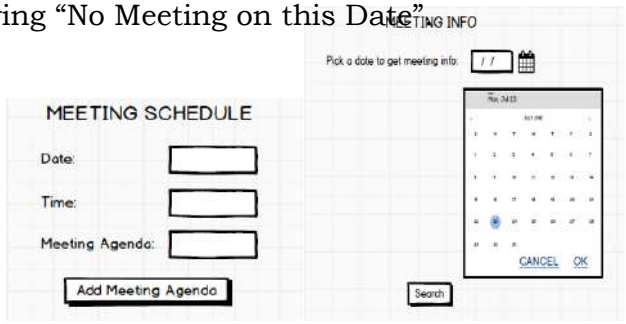
Experiments	
Sl.No.	**List of problems for which student should develop program and execute in the Laboratory**
1.	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone Number.\ 
2.	Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.

<table>
<tr><td></td><td>
</td></tr>
<tr><td>3.</td><td>Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules:

Password should contain uppercase and lowercase letters.
Password should contain letters and numbers.
Password should contain special characters.
Minimum length of the password (the default value is 8).

On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying “Successful Login” or else display a toast message saying “Login Failed”. The user is given only two attempts and after that display a toast message saying “Failed Login Attempts” and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.

</td></tr>
<tr><td>4.</td><td>Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.

</td></tr>
<tr><td>5.</td><td>Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a Text View control.</td></tr>
</table>

	
6.	Create two files of XML and JSON type with values for City_ Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
7.	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice. 
8.	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts. 
9.	Write a program to enter Medicine Name, Date and Time of the Day as input from the user and store it in the SQLite database. Input for Time of the Day should be either Morning or Afternoon or Evening or Night. Trigger an alarm based on the Date and Time of the Day and display the Medicine Name.

	
10.	Develop a content provider application with an activity called "Meeting Schedule" which takes Date, Time and Meeting Agenda as input from the user and store this information into the SQLite database. Create another application with an activity called "Meeting Info" having Date Picker control, which on the selection of a date should display the Meeting Agenda information for that particular date, else it should display a toast message saying "No Meeting on this Date". 

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop, test, and debug Android applications by setting up and using the Android development environment.
CO2	Implement adaptive, responsive user interfaces suitable for various screen sizes and devices.
CO3	Analyze and Implement solutions for managing long-running tasks and background processes in Android applications.
CO4	Apply appropriate methods for storing, retrieving, and sharing data in Android applications using databases and content providers.
CO5	Develop security features and permission handling mechanisms in Android applications.

Text Book	
1	**"Android Programming – Pushing the Limits",** Erik Hellman, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197

Reference Books	
1	**"Head First Android Development",** Dawn Griffiths and David Griffiths, 1st Edition, O"Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
2	**"Android Programming: The Big Nerd Ranch Guide",** Bill Phillips, Chris Stewart and Kristin Marsicano, 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054

Web links and Video Lectures (e – Resources)	
1	https://legacy.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts
2	https://youtu.be/y3kKoG5hO20?si=q8wXy4N8bVt1_Exq
3	https://youtu.be/nvrA57SMqxI?si=vKazTQL2BmzJg7Vf
4	https://youtu.be/iRfw3OPVJ0Q?si=016Hak9P0ZAog1zO
5	https://youtu.be/HM8ttKXUGA0?si=EhfkMY0RT7K-iMHo

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	3		1	1	1	1	1
CO2	2	2	2	1	3		1	1	1	1	1
CO3	2	2	2	1	3		1	1	1	1	1
CO4	2	2	2	1	3		1	1	1	1	1
CO5	2	2	2	1	3		1	1	1	1	1

Semester: IV					
Metaphysical Science					
Course Code	**:**	BMP409	**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	1:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	15 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	HSSMC	**SEE Duration**	**:**	1 Hr.

Course Learning Objectives: This course will enable the students to	
CLO1	Explore the philosophical and spiritual aspects of the universe.
CLO2	Compare and contrast ontological & Epistemology theories
CLO3	Analyze metaphysical perspectives on time, space, and the origin of the universe.
CLO4	Inculcate the Metaphysical inquiries into the nature of mind and consciousness.
CLO5	Apply and analyze the nature of reality, existence, and universe beyond the physical sciences.

Module 1	**03 Hrs**
Introduction to Metaphysics: Definition **of Metaphysics**, scope, and historical roots (Aristotle, Plato, Kant). Distinction between metaphysics, physics and spirituality. **Branches of Metaphysics:** Ontology, cosmology, epistemology, and their interconnections. **Key Metaphysical Questions:** Why is there something rather than nothing? The nature of abstract entities (numbers, moral values). **Textbook2, Ch.1&2**	
Module 2	**03 Hrs**
Ontology & Epistemology **Ontology (Study of Being):** Materialism vs. Idealism vs. Dualism, The Problem of Universals (Realism vs. Nominalism). **Epistemology (Study of Knowledge):** Rationalism (Descartes) vs. Empiricism (Locke, Hume). Theories of truth (Correspondence, Coherence, Pragmatic). **Skepticism & Constructivism:** Can we truly know reality? (Descartes' Evil Demon, Simulation Theory). **Textbook2, Ch.3-5**	
Module 3	**03 Hrs**
Cosmology – Metaphysical Perspectives on the Universe Philosophical cosmology vs. physical cosmology, Metaphysical views on time, space, and the origin of the universe, The Anthropic Principle and Fine-Tuning debate, Creation, causality, and the infinite regress problem, Multiverse theory and its metaphysical implications, Spiritual and ancient cosmologies: Vedic, Taoist, and Indigenous models. **Textbook1, Ch.1, Textbook2, Ch.6-7**	
Module 4	**03 Hrs**
Mind and Consciousness Definition of mind and consciousness, Mind-body problem: Dualism vs. Physicalism, Theories of consciousness: Integrated Information Theory (IIT), Global Workspace, Panpsychism, Eastern and Western views of the self and mind; Artificial intelligence and machine consciousness, Role of consciousness in observation and decision-making. **Textbook1, Ch.2, Textbook2, Ch.8**	

Module 5	03 Hrs
Quantum Healing and Energy Medicine Basics of quantum mechanics (superposition, entanglement, observer effect), Quantum theory and the mind: Role of consciousness in quantum collapse, Overview of Quantum Healing – Deepak Chopra's model, Energy fields: Biofield theory, chakras, subtle energy systems, Placebo effect, intention and non-local healing, Implications for engineering bio-resonant technologies. **Textbook1, Ch. 3-15**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess the nature of reality, existence and the universe.
CO2	Evaluate the competing **ontology** and epistemological frameworks.
CO3	Interpret the various multiverse models and their philosophical significance.
CO4	**Analyze** the *mind-body problem* and theories of consciousness.
CO5	Differentiate the theoretical and practical intersections between quantum physics, quantum healing and meditation.

Text Books	
1	Quantum Metaphysics, Tarja Kallio-Tamminen, Oy 2004, ISBN 952-10-1927-1 Otamedia
2	Metaphysics-A Very Short Introduction, Stephen Mumford, Sl. No. 20129780191640261, 2012, 0191640263, OUP Oxford,

Reference Books	
1	Deepak Chopra M.D., Quantum Healing (Revised and Updated): Exploring the Frontiers of Mind/Body Medicine, 2015.
2	Deepak Chopra M.D., Quantum Body: The New Science of Living a Longer, 2023, Healthier, More Vital Life

Weblinks	
1	https://www.yogajournal.com/meditation/
2	https://youtube.com/shorts/JgCVh6wwgNg?si=R87-PGIrUSII774w
3	https://www.youtube.com/watch?v=XvyuUqlX7fE
4	https://core.ac.uk/download/pdf/14914967.pdf
5	https://www.youtube.com/watch?v=_ba0yIAZ9ok
6	https://www.youtube.com/watch?app=desktop&v=fzxohf49loU
7	https://www.youtube.com/watch?v=SSGKowtXS3Y
8	https://www.youtube.com/watch?v=r_piRatnFlY

CO–PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2				2	2				3
CO2	3	2	2	2		2	2				3
CO3		3				2	2				2
CO4		3				2	2				
CO5		3				2	2				

Semester: IV					
National Service Scheme					
Course Code	**:**	BNS410	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	24 Hrs	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the community in general in which they work
CLO2	Identify the needs and problems of the community and involve them in problem –solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions t
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CL05	Appraise the importance of ethical issues and team working abilities pertaining to the social services

Activity– 1	**08 Hrs**
Water conservation techniques – Role of different stakeholders– Implementation	
Activity – 2	**08 Hrs**
Preparing an actionable business proposal for enhancing the village income and approach for implementation.	
Activity – 3	**08 Hrs**
Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution

Sl.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual al or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Preparing an actionable business proposal for	May be individual al or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus	Group selection /proper consultation/ Continuous monitoring/	Report should be submitted by individual to the	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

	enhancing the village income and approach for implement ation.		etc…..	Information board	concerned evaluation authority	
3	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individu al or team	Local government / private/ aided schools/Governmen t Schemes officers/ etc…..	School selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for 4th Semester)

Sl. No.	Practice Session Description
1.	Lecture session by NSS Officer
2.	Selection of topic, Commencement of activity and its progress
3.	Execution of Activity
4.	Case study based Assessment, Individual performance
5.	Sector wise study and its consolidation
6.	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In the 4th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 4th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Assessment Details for CIE (100 Marks)

Weightage	CIE- 100 Marks
Selection of Topic, Commencement of activity and its progress	40 Marks
Case study based Assessment	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of semester with Report	20 Marks
Total Marks for the course in each semester	100 Marks

Suggested Learning Resources:	
Books:	
1	NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2	Government of Karnataka, NSS cell, activities reports and its manual.
3	Government of India, NSS cell, Activities reports and its manual.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						3					3
CO2						3					3
CO3						3					3
CO4						3					3
CO5						2	3	3			3

Semester: IV					
Physical Education (PE) (Sports and Athletics)					
Course Code	**:**	BPE410	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:1	**CIE**	**:**	100 Marks
Total Hours	**:**	24 Hrs	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop an understanding of ethical principles and moral values and their importance in sportsmanship, fair play, and personal conduct in games and athletic activities.
CLO2	Acquire practical skills and demonstrate technical proficiency in selected sports or athletic events through structured physical training and performance.
CLO3	Understand the role of effective organization, administration, and management in the successful conduct of sports events and athletic programs.

Module – 1	**4 Hrs**
Ethics and Moral Values A. Ethics in Sports B. Moral Values in Sports and Games	
Module – 2	**16 Hrs**
Specific Games (Any one to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Athletics (Track Events) – Any event as per availability of Ground	
Module-3	**4 Hrs**
Role of Organization and administration	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the principles of ethics and moral values and their application in sports and games.
CO2	Demonstrate fundamental skills, techniques and rules of the selected game or athletic event.
CO3	Apply sportsmanship, fairness and respect for rules during practice and competition
CO4	Analyze the role of organization and administration in conducting sports events effectively
CO5	Develop teamwork, leadership and decision-making skills through participation in sports activities

Scheme and Assessment for auditing the course and Grades:

Sl. No.	**Activity**	**Marks**
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2						3	3			
CO2	3		2		2		1	2	3		
CO3	2		1				3	3	2		
CO4	2	2				2		2	3		2
CO5	1	2							3		2

Semester: IV					
Yoga					
Course Code	:	BYO410	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	12 Hrs	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Describe patanjali's ashtanga yoga and its role in holistic well-being.
CLO2	Perform the suryanamaskar sequence with correct breathing and posture.
CLO3	Identify different types of asanas with their techniques and benefits.
CLO4	Utilize the knowledge of kapalabhati with proper technique and safety measures.
CLO5	Apply pranayama techniques to enhance physical and mental health.

Module - 1	**02 Hrs**
Patanjali's Ashtanga Yoga: Introduction, its need and importance, Eight limbs of Yoga – overview, **Yama:** Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha **Niyama:** Shoucha, Santosha, Tapa, Svaadhyaya, Eshvarapranidhana **Text Book 1: Ch. 1 (Part 1)**	
Module - 2	**02 Hrs**
Surya Namaskar: Concept and significance of Surya Namaskar, 12-step Surya Namaskar sequence, Practice - 4 rounds of Surya Namaskar, Breathing coordination and posture alignment. **Text Book 1: Ch. 2 (Part 2)**	
Module - 3	**03 Hrs**
Asanas: Meaning of Asana, Need and importance of practicing Asanas, Classification of Asanas, Sitting Asanas - Sukhasana, Paschimottanasana, Standing Asanas - Ardhakati Chakrasana, Parshva Chakrasana, Prone Line Asana - Dhanurasana, Supine Line Asanas - Halasana, Karna Peedasana, For each Asana - Meaning by name, Technique of performing, Precautionary measures, Benefits **Text Book 1: Ch. 2 (Part 2)**	
Module - 4	**02 Hrs**
Kriyas: Introduction to Shatkarmas (Cleansing practices), Meaning and importance of Kapalabhati, Technique of Kapalabhati (40 strokes/min, 3 rounds), Precautionary measures and benefits. **Text Book 1: Ch. 3 (Part 3)**	
Module - 5	**03 Hrs**
Pranayama: Meaning, need, and importance of Pranayama, Types of Pranayama and their benefits, For each type - Meaning by name, Technique, Precautionary measures, Benefits, Types included – Suryanuloma-Viloma, Chandranuloma–Viloma, Suryabhedana, Chandra Bhedana, Nadishodhana **Text Book 1: Ch. 3 (Part 3)**	
Course Outcomes: After completing the course, the students will be able to	

CO1	Summarize patanjali's ashtanga Yoga and its significance in promoting daily well-being.
CO2	Demonstrate surya namaskar with correct sequence, breathing and posture alignment.
CO3	Classify various types of asanas with their benefits and precautions.
CO4	Utilize the knowledge to practice kapalabhati with correct technique, breathing rhythm and safety guidelines.
CO5	Apply pranayama to improve overall physical fitness and mental wellness.

Text Book	
1	"The Illustrates Light on Yoga" by BKS Iyengar, HarperCollins Publishers, ISBN-81:7223-606-9

Reference Books	
1	Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245
2	Yoga Instructor Course hand book published by SVYASA University, Bengaluru
3	Yogapravesha in Kannada by Ajitkumar
4	Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLzF4lOyPf_Z9yQ_Gphjh1wZ5fEhMg6hmP
2	https://www.youtube.com/playlist?list=PLOzRYVm0a65cCcY4qKX5MIyJxBt7hJgQY
3	https://youtu.be/KB-TYlgd1wE
4	https://youtu.be/aa-TG0Wg1Ls

CO – PO MAPPING

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

Semester: III-VI					
Music					
Course Code	:	BMU310/410/509/610	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	26 Hrs	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Objectives: This course will enable the students to	
1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
5	Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi.

Module -I	**03 Hrs**
Preamble Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela **Textbook1, V-1 Ch. 1-4**	
Module – II	**03 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **Textbook2 – Ch. 4-7**	
Module –III	**03 Hrs**
Composers Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa **Textbook3 – Ch. 2-5**	
Module –IV	**03 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Textbook1,V-4 – Ch. 2-6**	
Module –V	**14 Hrs**
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga	

Textbook1, V-1&2

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala.
CO2	Identify and interpret basic Carnatic compositions using standard notation.
CO3	Summarize the contributions of composers.
CO4	Classify Indian musical instruments and describe their construction and use.
CO5	Demonstrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books	
1	South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, The Indian Music Publishing House, Chennai.
2	A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, CBH Publications
3	Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi.

Reference Books	
1	Music of India, B. Chaitanya Deva, Munshiram Manoharlal Publishers
2	Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, Asian Educational Services

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3		1		1		1	1	1		1
CO2	3		3	1	2	1	2	1	1		1
CO3	1				1	1	1		1		
CO4	2		2		3	1	1	1	1		1
CO5	3			1	2	1	1	1	1		1

Semester: IV					
Competency Enhancement Course-2					
Course Code	**:**	BCE411	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	2:0:0	**CIE**	**:**	100 Marks
Total Hours	**:**	40 Hrs	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Competency enhancement course-1
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals and elementary algebra. comprehension of basic English
Knowledge on Connected Tools (If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Enhance Quantitative Problem-Solving Skills
CLO2	Master Data Interpretation and Visual Analysis
CLO3	Strengthen Logical Reasoning and Spatial Intelligence
CLO4	Develop Advanced Verbal Aptitude and Communication Accuracy
CLO5	Sharpen Critical Thinking through Assumptions and Analytical Judgement

Module – 1	**8 Hrs**

Partnership

Definition of Partnership, Types of Partnerships (Simple and Compound), Calculation of Profit Sharing Ratio, Capital and Time of Investment, Working and Sleeping Partners, Admission and Retirement of Partners, Distribution of Profits and Losses, Partnership Formulas, Complex Partnership Problems.

Time and Work

Definition and Concept of Time and Work, Relation between Work, Time, and Efficiency, Calculation of Individual and Combined Work, Work Rate and Work Done in a Given Time, Efficiency Comparison of Different Workers, Time Taken by Individuals or Groups, Alternate Work and Negative Work (Destructive Work), M:W:D Rule (Men:Work:Days Problems), Work Equivalence Formula, Problems Involving Wages Based on Work, Pipes and Cisterns (Work with Inlets and Outlets), Successive Work Distribution, Complex Time and Work Questions

Coding and Decoding

Letter Coding, Number Coding, Symbol Coding, Mixed Letter-Number Coding, Substitution Coding, Decipher Coding, Direct Coding-Decoding, Conditional Coding, Message Coding, Operations-Based Coding-Decoding, and Complex Coding-Decoding Problem

Analogy

Number Analogy, Alphabet Analogy (using letter sequences or codes), Symbol Analogy, Figure/Pattern Analogy, Geometrical Shapes Analogy, Matrix-Based Analogy, Series-Based Numeric Analogy, Mirror and Water Image Analogy, Classification-Based Figure Analogy, Embedded Figure Analogy, Complex Numerical and Visual Analogy Problems.

Textbook-1, Ch-36

Module – 2	**8 Hrs**

Time, Speed and Distance

Definition and Relationship of Time, Speed, and Distance, Units and Conversion of Speed and Distance, Average Speed, Relative Speed, Problems on Trains, Problems on Boats and Streams, Upstream and Downstream Concepts, Races and Games, Time to Meet/Opposite Direction Problems, Circular Tracks, Shortcut Tricks and Application-Based Problems.

Trains, Boats and Streams, Races

Trains: Problems on Trains, Time Taken to Cross a Stationary Object, Time Taken to Cross Another Moving Train, Relative Speed in Same and Opposite Direction, Length of Train and Platform Calculations, Speed and Time Conversions, Overtaking and Passing Scenarios, Shortcut Tricks for Train Problems.

Boats and Streams: Upstream and Downstream Concepts, Speed of Boat in Still Water, Speed of Stream, Calculation of Effective Speed (Upstream and Downstream), Time and Distance in Streams, Problems on Boats Overtaking/Meeting, Relative Speed in Water, Application-Based Boat and Stream Questions.

Races: Types of Races (Straight, Circular, Relay), Start Types (Head Start, Dead Heat), Calculating Winner and Margin, Calculation of Lead or Lag, Relative Speed in Races, Time Calculations to Meet or Overtake, Race Completion Time, Use of Ratio and Proportion in Races, Application-Based Race Problems.

Seating Arrangement

Linear Arrangement, Circular Arrangement, Square/Rectangular Arrangement, Single-Row and Double-Row Arrangements, Facing Inside and Outside Arrangements, Arrangement Based on Directions (Left/Right/Clockwise/Counterclockwise), Seating Based on Conditions or Constraints, Position and Order Determination, Seating with Blood Relations or Attributes, Arrangement with Vacant Seats.

Data Arrangement

Linear Data Arrangement, Circular Data Arrangement, Matrix/Table-Based Data Arrangement, Parallel/Double Row Arrangement, Attributes/Property-Based Arrangement (with multiple characteristics), Sequencing and Ranking Arrangement, Floor/Building Arrangement, Conditional Arrangement (with Direct and Indirect Clues), Application of Consolidated Table and Matrix Methods.

Textbook -1, Ch-14-18

Module-3	**8 Hrs**

Permutation and Combination

Understanding the difference between the permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of 2n, Arrangement in a circle.

Probability

Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes.

Clocks and Calendars

Clocks: Calculation of Angle Between Hands (Hour, Minute, Second), Time Gains and Losses by Clocks, Number of Times Hands Coincide or Oppose, Incorrect/Slow/Fast Clocks, Mirror and Water Image Questions on Clocks, Alarm and Time Calculation Problems, Calculation of Overlapping/Adjacent Hands, Problems on Clock Striking.

Calendars: Odd Days Concept, Leap Year and Ordinary Year Calculation, Counting Odd Days in Multiple Years, Day of the Week Calculation for a Given Date, Calendar Repetition, Month and Year Code Methods, Finding Dates with Same Day, Calculation of Future/Past Day from a Given Day, Number of Sundays/Saturdays/Specific Weekdays in a Period, Day-Difference Problems.

Textbook -1, Ch6-9 & 13-16

Module-4	**8 Hrs**

Data Interpretation

Tables, Bar Graphs, Line Graphs, Pie Charts, Caselets (Paragraph-based Data Sets), Radar Charts, Mixed or Combination Graphs (Multiple Data Forms Together), Data Comparison and Analysis, Calculation-Based Data Interpretation, Ratio and Percentage Interpretation, Data Sufficiency in Data Interpretation.

Ages

Present age and future age calculations, past age calculations, age problems in ratios, age difference problems, multiple or submultiple age relations, product of ages problems, age problems involving sum of ages, age relationships in family contexts, age-based word problems with equation formulation, and age problems involving time intervals such as years ago or years hence.

Crypt arithmetic

Basic concepts, addition, subtraction, multiplication of coded alphabets, Types of cryptarithm.

Syllogisms

Basic Concepts of Syllogism, Types of Statements (A, E, I, O), Venn Diagram Representation, Rules of Syllogism, Direct and Indirect Syllogism Questions, Condition-based Syllogism, Coded Syllogism, Double/Triple Syllogism Problems, Syllogism with Quantifiers, Syllogism in Data Interpretation, and Conclusions Drawing from Statements.

Textbook -1, Ch28-29

Module-5	**8 Hrs**

Mensuration

Basic Geometrical Figures, Perimeter and Area of Plane Figures (Square, Rectangle, Triangle, Parallelogram, Rhombus, Trapezium), Area and Circumference of Circle, Area of Sector and Segment of a Circle, Surface Area and Volume of Cuboid, Surface Area and Volume of Cube, Surface Area and Volume of Cylinder, Surface Area and Volume of Cone, Surface Area and Volume of Sphere and Hemisphere, Frustum of a Cone, Conversion between Units of Measurement, Application-Based Problems on Mensuration.

Data sufficiency

Statement Evaluation, Identifying Sufficient and Insufficient Statements, Dealing with Irrelevant Information, Definite vs. Indefinite Information, Elimination Method, Data Sufficiency on Blood Relations, Data Sufficiency on Order and Ranking, Data Sufficiency on Direction and Distance, Data Sufficiency on Coding-Decoding, Data Sufficiency on Seating Arrangement, Data Sufficiency on Puzzles, Data Sufficiency on Syllogism, Data Sufficiency on Alphanumeric Series.

Visual Reasoning and Cubes

Visual Reasoning: Figure/Image Series Completion, Odd-One-Out (Visual Discrimination), Mirror Images, Water Images, Embedded Figures, Paper Folding and Cutting, Analytical Puzzles with Patterns, Figure Counting, Pattern Completion, Analogy in Figures, Classification of Visual Data, Venn Diagrams, Direction and Distance with Visuals.

Cubes: Basic Properties of Cubes (Faces, Vertices, Edges), Cube and Dice Basics, Counting of Smaller Cubes, Painted Cube Problems (Counting Cubes with 0/1/2/3 Painted Faces), Cube Cutting and Partitioning, Dice (Number/Colour/Letter Arrangements), Unfolded (Net) Cube to Folded Cube Problems, Opposite and Adjacent Faces of Dice, Identification of Hidden Surfaces, Face Rotation and Positioning, Shortcuts and Tricks for Cubes and Dice Problems

Para Jumbles and Cloze Test

Sentence Jumble/Ordering, Identification of Opening/Closing Sentences, Logical Sequencing and Linking, Transitional Words and Connectors, Theme Identification in Jumbled Passages, Cloze Test with Contextual Blanks, Vocabulary and Grammar-based Blanks, Contextual Inference for Blank Filling, Error Detection in Cloze Test.

Reading Comprehension

Main Idea Identification, Factual/Inference-based Questions, Tone and Attitude Analysis,

Vocabulary in Context, Passage Summarization, Structure and Organization of Passage, Logical Completion of Paragraphs, Supporting/Contradicting Evidence, Eliminating Irrelevant Information, Comparative Comprehension Passages. **Critical Reasoning** Assumption-Based Questions, Strengthen/Weaken the Argument, Inference Drawing, Conclusion Identification, Evaluating Arguments and Evidence, Identifying Flaws in Reasoning, Paradox/Discrepancy Resolution, Cause-and-Effect Reasoning, Analogy and Parallel Reasoning, Application of Logical Principles. **Textbook 1,Ch22-25, Textbook 2 & 3**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply arithmetic and logical reasoning to solve problems.
CO2	Develop spatial and logical skills to solve cube, dice, puzzle and seating arrangement questions.
CO3	Develop reading, vocabulary and grammar through para jumbles, sentence completion and idioms.
CO4	Enhance verbal reasoning by solving analogies, rearranging sentences and identifying assumptions and conclusions.
CO5	Apply combinatorics and probability to solve permutation, combination and crypt arithmetic problems.

Text Books	
1	**Quantitative Aptitude for Competitive Examinations,** R.S. Aggarwal Chand Publishing. – 2023.
2	**Word Power Made Easy,** Norman Lewis, Published by PENGUIN INDIA – 2015, (ISBN- 978-0143424680)
3	**How to Prepare for Quantitative Aptitude for the CAT,** Arun Sharma 6th Edition, McGraw-Hill Education – 2014, (ISBN- 978-9339205126)

Reference Books	
1	**Puzzle Test & Seating Arrangements,** K. Kundan,1st Edition, BSC Publishing Company Pvt Ltd. – 2023, (ISBN: 9789394666023)
2	**A Modern Approach to Verbal & Non-Verbal Reasoning,** R.S. Aggarwal, 2025-26 Edition, S. Chand Publishing -2024

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/KWZ0lR8cCwc
2	https://youtu.be/mBtBD1N7ywQ
3	https://youtu.be/B9MhxmcwnpQ
4	https://youtu.be/VaEbefWFIlc
5	https://youtu.be/3AL_6EQmnkY

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2									1
CO2	2	2									
CO3	1	1							3		
CO4	2	2	2						2		1
CO5	3	3	2								1

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Building Proficient Computer Science Engineers having Core Values to Solve Real Life Problems

Department Mission

- Strengthening Students with Fundamental and Applied aspects in Design and Implementation of Computational Systems.
- Empowering the Students with Sound Knowledge in AI &ML, Data Analytics, Block Chain, AR and VR systems to Solve Multidisciplinary Problem.
- Developing Analytical Skills to meet the Complex, Societal and Industrial needs.
- Promoting Research blend of mind among Students enabling Continuous Learning.
- Encouraging Entrepreneurship including Ethical Values and Team building abilities.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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