The National Institute of Engineering

Scheme of Teaching & Examination - 2022

Effective from the Academic year 2023-24

Department: Computer Science and Engineering

B.E. 2022 Admitted Batch

Semester: IV

Sl. No.	Type of Course	Course Code	Course Title	Teaching Department (TD)	Question Paper setting Board (PSB)	Teaching Hrs/Week				Examination				Credits
						L	T	P	S	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC/BSC	BCS401	Analysis & Design of Algorithms	TD: CS	PSB: CS	3	0	0	0	3	50	50	100	**3**
2	IPCC	BCS402	Microcontrollers	TD: CS	PSB: CS	3	0	2	0	3	50	50	100	**4**
3	IPCC	BCS403	Database Management Systems	TD: CS	PSB: CS	3	0	2	0	3	50	50	100	**4**
4	PCCL	BCSL404	Analysis & Design of Algorithms Lab	TD: CS	PSB: CS	0	0	2	0	2	50	50	100	**1**
5	ESC	BCS405x	ESC/ETC/PLC	TD: CS	PSB: CS	2	2	0	0	3	50	50	100	**3**
6	AEC/SEC	BCS456x	Ability Enhancement Course (AEC) - IV	TD: CS	PSB: CS	If the course is a Theory 1 If the course is a Laboratory 0	0 0	0 2	0 0	1 2	50	50	100	**1**
7	BSC	BBOK407	Biology for Engineers	TD: Chem	PSB: Chem	2	0	0	0	2	50	50	100	**2**
8	UHV	BUHK408	Universal Human Values and Professional Ethics	TD: CS	PSB: CS	1	0	0	0	-	50	-	50	**1**
9	MC	BNSK459	National Service Scheme (NSS)	NSS Coordinator		0	0	2	0	-	100	-	100	**0**
		BPEK459	Physical Education (PE) (Sports & Athletics)	PED										
		BYOK459	Yoga	Yoga Teacher										
										Total	**550**	**350**	**850**	**19**

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Engineering Science Course (ESC/ETC/PLC)			
BCS405A	Discrete Mathematical Structures	BCS405C	Optimization Technique
BCS405B	Graph Theory	BCS405D	Linear Algebra
Ability Enhancement Course - IV			
BCS456A	Green IT and Sustainability	BCS456C	UI/UX (Lab)
BCS456B	Capacity Planning for IT	BCS456D	Technical writing using LATEX (Lab)

Code: BCS401 **Course: Analysis and Design of Algorithms**
Credits: 3 **L:T:P - 3:0:0**
SEE: 50 Marks **CIE: 50 Marks**
SEE Hours: 03 **Max. Marks: 100**

Prerequisites if any	Recurrence Relations, Data Structures
Learning objectives	• To learn the methods for analyzing algorithms and evaluating their performance. • To demonstrate the efficiency of algorithms using asymptotic notations. • To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound. • To learn the concepts of P and NP complexity classes

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.	Understand, Analyze
CO2	Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.	Apply
CO3	Make use of transform &conquer, dynamic programming and greedy approaches to solve the given real world or complex computational problems.	Apply
CO4	Illustrate backtracking, branch & bound and P,NP and NP Complete problems	Apply

Mapping with POs and PSOs:

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

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1	**INTRODUCTION:**			
1.1	What is an Algorithm?	1	0	0
1.2	Fundamentals of Algorithmic Problem Solving.	2	0	0
	FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY:			
1.3	Analysis Framework	1	0	0
1.4	Asymptotic Notations and Basic Efficiency Classes	1	0	0

1.5	Mathematical Analysis of Non recursive Algorithms	1	0	0
1.6	Mathematical Analysis of Recursive Algorithms.	1	0	0
	BRUTE FORCE APPROACHES:			
1.7	Selection Sort	1	0	0
1.8	Sequential Search	1	0	0
	Module – 2			
	BRUTE FORCE APPROACHES (contd..):			
2.1	Brute Force String Matching	1	0	0
2.2	Exhaustive Search (Travelling Salesman problem)	1	0	0
2.3	Exhaustive Search (Knapsack Problem).	1	0	0
	DECREASE-AND-CONQUER:			
2.4	Topological Sorting.	1	0	0
	DIVIDE AND CONQUER:			
2.5	Merge Sort	1	0	0
2.6	Quick Sort	1	0	0
2.7	Strassen's Matrix Multiplication.	2	0	0
	Module – 3			
	TRANSFORM-AND-CONQUER:			
3.1	Balanced Search Trees	2	0	0
3.2	Heaps and Heapsort.	2	0	0
	SPACE-TIME TRADEOFFS:			
3.3	Sorting by Counting: Comparison counting sort	2	0	0
3.4	Input Enhancement in String Matching: Horspool's Algorithm.	2	0	0
	Module – 4:			
	DYNAMIC PROGRAMMING:			
4.1	Three basic examples	1	0	0
4.2	The Knapsack Problem and Memory Functions	2	0	0
4.3	Warshall's and Floyd's Algorithms.	2	0	0
	THE GREEDY METHOD:			
4.4	Prim's Algorithm	1	0	0
4.5	Kruskal's Algorithm	1	0	0
4.6	Dijkstra's Algorithm	1	0	0
	Module – 5			
	LIMITATIONS OF ALGORITHMIC POWER:			
5.1	Decision Trees	1	0	0
5.2	P, NP, and NP-Complete Problems.	3	0	0
	COPING WITH LIMITATIONS OF ALGORITHMIC POWER:			
5.3	Backtracking (n-Queens problem)	1	0	0
5.4	Backtracking (Subset-sum problem)	1	0	0
5.5	Branch-and-Bound (Travelling Salesman Problem),	1	0	0
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	-
	Total No. of Practical Hours			**00**

Textbook

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

Module-1:

Chapter 1 (Sections 1.1,1.2)
Chapter 2(Sections 2.1,2.2,2.3 (Example 2 & Example 4 Only) ,2.4 (Example 2 Only))
Chapter 3(Section 3.1(only Selection sort),3.2(only sequential search)

Module-2:

Chapter 3(Section 3.4),
Chapter 4 (Sections 4.1,4.2)
Chapter 5(Section 5.1,5.2, 5.4(only Strassen's matrix multiplication)

Module-3:

Chapter 6 (Sections 6.3,6.4)
Chapter 7 (Sections 7.1,7.2)

Module-4:

Chapter 8(Sections 8.1,8.2,8.4)
Chapter 9 (Sections 9.1,9.2,9.3)

Module-5:

Chapter11 (Section 11.2, 11.3)
Chapter 12 (Sections 12.1,12.2(only Travelling Salesman Problem)

Reference books

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

Online Resources:

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

Code: BCS402 **Course: Microcontrollers**
Credits: 4 **L:T:P - 3:0:2**
SEE: 50 Marks **CIE: 50 Marks**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	Digital Design and Computer Organization
Learning objectives	1. To provide the knowledge of the fundamentals of ARM-based systems and basic architecture of CISC and RISC 2. To familiarize with ARM programming modules along with registers, CPSR and Flags 3. To develop ALP/C Program using various instructions to program the ARM controller 4. To discuss and demonstrate the Exceptions and Interrupt handling mechanism, ARM Firmware packages and Cache memory polices

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the fundamentals of ARM-based systems and basic architecture of CISC and RISC	Understanding
CO2	Familiarize with ARM programming modules along with registers, CPSR and Flags	Apply
CO3	Develop Assembly Language/C Program using various instructions to program the ARM controller	Apply
CO4	Demonstrate the Exceptions and Interrupt handling mechanism in Microcontrollers	Apply
CO5	Discuss the ARM Firmware packages and Analyze Cache memory polices	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PS01	PS02
CO1	3	-	-	-	-	-	-	-	-	-	-	-		-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-		-	-
CO3	3	3	3	-	3	2	2	-	-	-	-	3		3	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-		2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-		-	-

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1: ARM EMBEDDED SYSTEMS & PROCESSOR FUNDAMENTALS				
1.1	ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy	1	0	0
1.2	Embedded System Hardware, Embedded System Software	2	0	0
1.3	ARM Processor Fundamentals: Registers, Current Program Status Register	2	0	1
1.4	Pipeline	1	0	0
1.5	Exceptions Interrupts, and the Vector Table	2	0	0
	Textbook 1: Chapter 1 - 1.1 to 1.4, Chapter 2 - 2.1 to 2.4			
Module – 2:ARM INSTRUCTION SET				
2.1	Introduction to the ARM Instruction Set: Data Processing Instructions	3	0	3
2.2	Branch Instructions, Single Register Transfer, Multiple Register Transfer	2	0	2
2.3	Software Interrupt Instructions, Program Status Register Instruction	2	0	-
2.4	Loading Constants	1	0	-
	Textbook 1: Chapter 3 - 3.1 to 3.2,3.3.1,3.3.3,3.4,3.5,3.6			

Module – 3: C COMPILERS AND OPTIMIZATION				
3.1	C Compilers and Optimization: Basic C Data Types	2	0	-
3.2	C Looping Structures	2	0	1
3.3	Register Allocation, Function Calls	2	0	1
3.4	Pointer Aliasing	2	0	-
	Textbook 1: Chapter 5.1 to 5.6			
Module – 4: EXCEPTION, INTERRUPT HANDLING AND FIRMWARE				
4.1	Exception and Interrupt Handling: Exception handling	1	0	2
4.2	ARM processor exceptions and modes, vector table, exception priorities	2	0	-
4.3	link register offsets, interrupts, assigning interrupts	1	0	-
4.4	interrupt latency, IRQ and FIQ exceptions	1	0	-
4.5	Firmware: Firmware and bootloader, ARM firmware suite, Red Hat redboot	3	0	-
	Textbook 1: Chapter 9.1 and 9.2, Chapter 10.1			
Module – 5: CACHE MEMORY				
5.1	CACHES: The Memory Hierarchy and Cache Memory	2	0	-
5.2	Caches and Memory Management Units, CACHE Architecture: Basic Architecture of a Cache Memory	2	0	-
5.3	Basic Operation of a Cache Controller, The Relationship between Cache and Main Memory	2	0	-
5.4	Write Buffers, Measuring Cache Efficiency, CACHE POLICY: Write Policy—Writeback or Writethrough	2	0	-
	Textbook 1: Chapter 12.1 to 12.3			
			-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**10**

Integrated Lab Component: Microcontrollers		
Sl No	**CO's**	**Experiments**
1	**CO2**	Using Keil software, observe the various Registers, Dump, CPSR, with a simple Assembly Language Programs (ALP)
2	**CO3**	Develop and simulate ARM ALP for Data Transfer, Arithmetic and Logical operations (Demonstrate with the help of a suitable program)
3	**CO3**	Develop an ALP to multiply two 16-bit binary numbers
4	**CO3**	Develop an ALP to find the sum of first 10 integer numbers
5	**CO3**	Develop an ALP to find the largest/smallest number in an array of 32 numbers
6	**CO3**	Develop an ALP to count the number of ones and zeros in two consecutive memory locations
7	**CO3**	Simulate a program in C for ARM microcontroller using KEIL to sort the numbers in ascending/desce using bubble sort
8	**CO3**	Simulate a program in C for ARM microcontroller to find factorial of a number
9	**CO4**	Demonstrate enabling and disabling of Interrupts in ARM
10	**CO4**	Demonstrate the handling of divide by zero, Invalid Operation and Overflow exceptions in ARM

Textbook:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan, Kaufman publisher,2008

Reference Book:

1. Raghunandan.G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication, 2019.,
2. Insider's Guide to the ARM7 based microcontrollers, Hitex Ltd.,1st edition, 2005

Online Resources:

1. Online Resource 1: Top Microcontroller Courses Online - Updated [April 2024] (udemy.com)
2. Online Resource 2: Microprocessors And Microcontrollers - Course (nptel.ac.in)

Code: BCS403 **Course: Database Management System**
Credits: 4 **L:T:P - 3:0:2**
SEE: 100 Marks **CIE: 100 Marks**
SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	1. Understand the fundamental concepts of databases, including database languages, architectures, and conceptual data modeling using entities and relationships. 2. Gain proficiency in relational database management systems, including the relational model, relational algebra, normalization, SQL, and transaction processing.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe fundamental concepts of database management systems, including architecture, languages, and functionalities.	Understand
CO2	Design and implement database schemas using entities, relationships, and normalization techniques.	Apply
CO3	Demonstrate proficiency in SQL for data manipulation, retrieval, and management tasks.	Apply
CO4	Analyze and compare concurrency control mechanisms in relational databases and NoSQL databases, understanding their respective advantages and limitations.	Analyze

Mapping with POs and PSOs:

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

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: Introduction to Databases			
1.1	**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.	2	-	0
1.2	**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence. Database languages, and interfaces, The Database System environment.	3	-	0
1.3	**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams, Specialization and Generalization	3	-	1
	Module – 2: Relational Databases			
2.1	**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.	3	-	0
2.2	**Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.	3	-	0
2.3	**Mapping Conceptual Design into a Logical Design:** Relational Database Design using	2	-	0

	ER-to-Relational mapping			
Module – 3: Normalization and SQL				
3.1	**Normalization:** Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	5	-	1
3.2	**SQL:** SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	3	-	2
Module – 4: SQL and Transactions				
4.1	**SQL:** Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL.	3	-	2
4.2	**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.	5	-	1
Module – 5: Concurrency control and NoSQL Databases				
5.1	**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.	4	-	1
5.2	**NoSQL Databases and Big Data Storage Systems:** Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems.	4	-	2
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		**00**	**-**
	Total No. of Practical Hours			**10**

PRACTICAL COMPONENT

Sl. No.	Experiments	COs
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 any three records in the employee table containing 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.	CO3
2.	Create a table called Employee that contains attributes EMPNO, ENAME, JOB, MGR, SAL and 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.	CO3
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, Salary. 2. Count number of employee names from employee table. 3. Find the Maximum age from the employee table. 4. Find the Minimum age from the employee table. 5. Find salaries of employees in Ascending Order.	CO3

	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)	CO4
5.	Create cursor for Employee table and extract the values from the table. Declare the variables, Open the cursor, and extract the values from the cursor. Close the cursor. Employee (E_id, E_name, Age, Salary)	CO4
6.	Install an Open-Source NoSQL Data base MongoDB & perform basic CRUD (Create, Read, Update & Delete) operations. Execute MongoDB basic Queries using CRUD operations.	CO5
7.	Project-based Experiment: The project should use all the database concepts covered in theory and laboratory sessions. Students can integrate other relevant concepts/technologies as required.	CO1, CO2, CO3, CO4.

Textbook:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.

Reference Book:

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.

Online Resources:

1. MIT OpenCourseWare Course Link: https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/
2. IIT Kharagpur Course Link: https://cse.iitkgp.ac.in/~pabitra/course/dbms/dbms_new.html
3. NPTEL Course Link: https://onlinecourses.nptel.ac.in/noc22_cs91/preview

NIE
ESTD : 1946

Analysis & Design of Algorithms Lab		Semester	4
Course Code	**BCSL404**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	2
Examination type (SEE)	Practical		

Course outcomes:

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

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

Sl.No	CO's	Experiments
1	CO1 to CO5	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	CO1 to CO5	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph.
3	CO1 to CO5	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	CO1 to CO5	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.
5	CO1 to CO5	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic programming method.
6	CO1 to CO5	a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd'salgorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.

7	CO1 to CO5	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
8	CO1 to CO5	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
9	CO1 to CO5	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.
10	CO1 to CO5	Design and implement C/C++ Program for N Queen's problem using Backtracking.

Suggested Learning Resources:

Textbook

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

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

Code: BCS405A **Course: Discrete Mathematical Structures**
Credits: 3 **L:T:P - 2:2:0**
SEE: 100 Marks **CIE: 50 Marks**
SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	Basics of number system, Mathematics
Learning objectives	1. To solve problems using concepts of Functions. 2. Solve problems using Relations and its properties. 3. To introduce Generating Functions and Recurrence Relations 4. To introduce concepts and properties of Graphs 5. To introduce the concepts of Trees and its properties.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply the concepts and properties of Functions and Relations in solving problem.	Apply
CO2	Solve problems using Recurrence Relations and Study its applications in computers.	Apply
CO3	Solve problems using concepts of graphs and analyze its real-world applications.	Apply
CO4	Synthesis tree structure paradigm.	Analyze

Mapping with POs and PSOs:

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

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1: Functions			
1.1	**Functions:** Cartesian Products and Relations	2	0	0
1.2	Plain and One-to-One, Onto Functions	1	1	0
1.3	The Pigeonhole Principle	1	1	0
1.4	Function Composition and Inverse Functions	1	1	0
	Module – 2: Relations			
2.1	**Relations:** Properties of Relations,	1	1	0
2.2	Computer Recognition – Zero-One Matrices and Directed Graphs	2	1	0
2.3	Partial Orders – Hasse Diagrams.	2	1	0
	Module – 3: Recurrence Relations			
3.1	**Recurrence Relations:** First order linear recurrence relations,	2	0	0
3.2	The Second order linear homogeneous recurrence relation with constant coefficients	1	1	0

3.3	Non Homogeneous recurrence relation	2	1	0
Module – 4: Graph Theory and Applications				
4.1	**Graph Theory and Applications**: Definitions and Examples Sub graphs, Complements	1	1	0
4.2	Graph Isomorphism, Vertex Degree, Euler Trails and Circuits	1	0	0
4.3	Planar Graphs	1	1	0
4.4	Hamilton Paths and Cycles	1	1	0
4.5	Graph Coloring, and Chromatic Polynomials	1	1	0
Module – 5: Trees				
5.1	**Trees:** Definitions, Properties, and Examples	2	1	0
5.2	Rooted Trees	1	1	0
5.3	Trees and Sorting	1	1	0
5.4	Weighted Trees and Prefix Codes	1	0	0
	Total No. of Lecture Hours	**25**	-	-
	Total No. of Tutorial Hours		**15**	**-**
	Total No. of Practical Hours			**00**

Textbook:

1. **Discrete and Combinatorial Mathematics,** Ralph P. Grimaldi, 5th Edition, PHI/Pearson Education, 2004.

Reference Book:

1. **Handbook of discrete and combinatorial mathematics**, Kenneth H.Rosen, John G.Michels.
2. **Mathematics of Computer Science**, Prof. Albert R.Meyer, MIT Open Course Ware.
3. **Concrete Mathematics: A foundation for computer science**, Ronald L.Graham, Donald Ervin Knuth, Oren Patashnik
4. **Graph Theory with Applications to Engineering and Computer Science** by NarsinghDeo, Prentice-Hall, 2004

Code: BCS456C **Course: UI/UX Lab**
Credits: 01 **L:T:P - 0:0:2**
SEE: 50 Marks **CIE: 50 Marks**
SEE Hours: 2 **Max. Marks: 100**

Prerequisites if any	NIL
Learning objectives	• Understand user experience design requirements, with design goals, metrics and targets. • Explore different prototyping methods, UX design principles with case examples. • Understand the role of design thinking concepts and mental models in UX design.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apply different UI design approaches for creating and designing different use cases. .	Apply
CO2	Illustrate the importance of user experience through stories.	Apply
CO3	Demonstrate different prototyping in relation to software engineering.	Apply

Mapping with POs and PSOs:

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

Mapping Strength: Strong– 3 Medium – 2 Low – 1

List of Experiments

Sl. No.	CO's	Experiments	No. of Practical Hours
1.	CO1	Create and Design A Logo For E-Commerce App.	2
2.	CO1	Create and Design A Basic Email Template.	2
3.	CO1	Design A Brochure That Showcases Different Features Of The E-Commerce App.	2
4.	CO2	Create User Personas & User Stories To Define A Problem Statement, Scope And Understand The Problem.	2
5.	CO2	Create Sketches And Low-Fidelity Wireframes Of The Scoped Solution.	2
6.	CO2	Create High-Fidelity Prototypes From The Wireframes.	2
7.	CO3	Create The Basic Responsive Elements Like Buttons, Input Elements To Understand Frames, Groups And Layouts.	2
8.	CO3	Design A Basic Clickable Prototyping Using Figma.	2
9.	CO3	Create A Design System For E Commerce App Using Grid And Spacing, Color System, And Ui Elements Like Icons, Images, Buttons, Etc.	2
		Total number of practical hours	**18**

Textbook:

1. REX HARTSON and PARDHA S. PYLA, The UX Book-Process and Guidelines for Ensuring a Quality User Experience, Morgan Kaufmann, Elsevier, 2012.

Online Resources:

1. https://www.freecodecamp.org/news/ui-ux-design-tutorial-from-zero-to-hero-withwireframe-prototype-figma/
2. https://www.edureka.co/blog/ui-ux-design-tutorial/
3. https://www.udemy.com/course/introtoux/

Course Code:	**BBOK407**	**Course:**	**Biology for Engineers**
Credits:	**2**	**L:T:P:S**	**2:0:0:0**
SEE:	**50% Marks**	**CIE:**	**50% Marks**
SEE Hours:	**2 Hrs**	**Max. Marks:**	**100 (50+50)**

Prerequisites if any	None
Learning objectives	1. Review the basics of cell biology and role of biomolecules. 2. Elucidate the significance of Biomechanics and Biomaterials

Course Outcomes:

On the successful completion of the course, the student will be able to

	Course Outcomes	Bloom's level
CO1	Explain the fundamentals of Life, Evolution, Biomolecules, Cell Biology & Genetics	Understand
CO2	Outline the physical principles regulating the systems of the human bodies	Understand
CO3	Describe the impact of Biomaterials on the fields of Engineering & Medicine	Understand
CO4	Summarize tissue engineering and clinical applications of materials	Understand

Mapping with POs and PSOs:

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

Strong: 3 Medium: 2 Low: 1

Course Content

	Module - 1	No. of Lecture Hours	No. of Tutorial Hours	Self-Learning Hours
1.1	**Cell basic unit of life:** Introduction, Origin, and evaluation of life. Structure and functions of a cell. Stem cells and their application.	2	-	-
1.2	Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins, and hormones.	3	-	-
	Module - 2			
2.1	**Application of biomolecules:** Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis,	2	-	-
2.2	Proteins in food production, lipids in biodiesel and detergents production, Enzymes in biosensors fabrication, food processing, detergent formulation, and textile processing.	3	-	-
	Module - 3			
3.1	**Adaptation of anatomical principles for bioengineering design:** Brain as a CPU system, Eye as a Camera system, Heart as a pump system.	3	-	-
3.2	Lungs as purification system, Kidney as a filtration system.	2	-	-
	Module - 4			
4.1	**Nature-bioinspired materials and mechanisms:** Echolocation, Photosynthesis, Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak.	3	-	-
4.2	Human Blood substitutes - haemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).	2	-	-
	Module - 5			
5.1	**Trends in bioengineering:** Muscular and Skeletal Systems as scaffolds, and tissue engineering, Bioprinting techniques and materials.	3	-	-
5.2	Electrical tongue and electrical nose in food science, DNA origami and	2	-	-

	Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis, Bio concrete, Bioremediation, Biomining.			
	Total No. of Lecture Hours	25	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Self learning Hours			-

Detailed Lesson Plan:

Sr No. of Module	Number of related learning Objectives	Weeks/ Dates	Online Mode		ICT Tool/ Platform/ LMS	Face-to-face Mode	
			Resource (OER/ URL/ IM/ CP)	Activity (Describe activity in detail)		Resource (OER/ URL/ IM/ CP)	Activity
1.1	1	1	Refer succeeding section titled ' Online Resources'	-	PPT, Smart Board, Moodle	-	Student Led Discussions & Presentations
1.2	1	1		-		-	
2.1	1	1		-		-	
2.2	1	1		-		-	
3.1	1	2		-		-	
3.2	1	2		-		-	
4.1	2	1		-		-	
4.2	2	1		-		-	
5.1	2	2		-		-	
5.2	2	2		-		-	

Assessment Pattern:

Bloom's level	Continuous Internal Examination			End Semester Examination
	Test 1	Test 2	Assignment/Quiz/AAT	
Remember	√	√	√	√
Understand	√	√	√	√
Apply				
Analyze				
Evaluate				
Create				

Text Books:

1. Biology for Engineers by G. K. Suraishkumar; Oxford University Press, 2019, First Edition

Reference Books:

1. Introductory Biomechanics: From Cells to Organisms by C. Ross Ethier and Craig A. Simmons; Cambridge University Press, 2012, Online Edition
2. Introduction to Biomaterials: Basic Theory with Engineering Applications, J. L. Ong, Mark R. Appleford, Gopinath Mani, Cambridge University Press, 2014, First Edition
3. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao, N Publishing, Bengaluru, 2023.
4. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
5. 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.

6. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
7. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
8. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
9. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
10. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
11. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
12. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
13. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Online Resources:

1. NOC: Biology for engineers and other non-biologists, IIT Madras; Dr. Madhulika Dixit, Prof. G.K. Suraishkumar, https://nptel.ac.in/courses/121106008
2. Introduction To Biological Engineering Design, MIT Open Courseware, https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
3. Introduction To Bioengineering, MIT Open Courseware, https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006

Course Code: BUHK408
Credits: 1
SEE: -

Course Name: Universal Human Values and Professional Ethics
L:T:P - 1:0:0
CIE: 50 Marks

Prerequisites if any	Nil
Learning objectives	1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings. 2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. 3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with nature

Course Outcomes:
On the successful completion of the course, the student will be able to

COs		**Bloom's level**
CO1	To understand the core aspirations of all human beings	Understand
CO2	To gain the universal human values and movement towards value-based living in a natural way	Apply
CO3	To fulfilling the human behavior and mutually enriching interaction with nature	Apply

Mapping with POs and PSOs:

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

S – Strong (3) M – Medium (2) L – Low (1)

Course Structure

Module – 1: Introduction - Need, Basic Guidelines, Content and Process for Value Education		**No. of Lecture Hours**	**No. of Tutorial Hours**
1.1	Understanding the need, basic guidelines, content and process for Value Education	1	Nil
1.2	Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration	1	Nil
1.3	Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority	1	Nil
1.4	Method to fulfill the above human aspirations: understanding and living in harmony at various levels . Practice session	2	Nil
Module – 2: Understanding Harmony in Myself, Family, Society and Human Relationship			
2.1	Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha	1	Nil
2.2	Understanding Harmony in the family – the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship	1	Nil

2.3	Understanding the meaning of Vishwas and Samman; Difference between intention and competence; respect and differentiation ; Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals	1	Nil
2.4	Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! Practice session	2	Nil
Module – 3: **Understanding Harmony in the Nature, Existence and Implications of the all Holistic on Professional Ethics**			
3.1	Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature	1	Nil
3.2	Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space.	1	Nil
3.3	Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify and develop appropriate technologies and management patterns for above production systems.	1	Nil
3.4	Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations. Practice session	2	Nil
	Total No. of Lecture Hours	15	
	Total No. of Tutorial Hours		Nil

Guidelines and Content for Practice Sessions

Practice Session 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them.

Expected outcome: The students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

Practice Sessions 2:

1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary & tasteful→ unnecessary & tasteful → unnecessary & tasteless → intolerable b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.

Expected outcome:

1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.

2. The students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing througbody.es, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body

Practice Session 3:

Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are:

1a. Do I want to make myself happy?

2a. Do I want to make others happy?
3a. Does the other want to make him happy?
4a. Does the other want to make me happy?
What is the answer? Intention (Natural Acceptance)
1b. Am I able to make myself always happy?
2b. Am I able to make others happy?
3b. Is the other able to make him always happy?
4b. Is the other able to make me always happy?
What is the answer? Competence
Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.

Expected outcome:

The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

Textbooks:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2.

References:

1. IIT Delhi, Modern Technology – the Untold Story

Course Code: BNSK459
Credits: Zero
SEE: NA
SEE Hours: NA

Course: National Service Scheme (NSS)
L:T:P 0:0:2
CIE: 100 Marks
Max. Marks: 100

Prerequisites if any	1. Students should have a service oriented mind set and social concern. 2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works. 3. Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time
Learning objectives	1. Understand the community in which they work 2. Identify the needs and problems of the community and involve them in problem-solving 3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems 4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes 5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse 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 and Implement government or self-driven projects effectively in the field.

Mapping with POs and PSOs:

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2		PSO 1	PSO 2	PSO 3	PSO 4
CO1	-	-	3	-	-	-	2	2	-	-	-	1		To be identified for each branch by Course Instructor			
CO2	-	3	-	-	-	-	2	-	-	-	-	-					
CO3	-	-	-	-	-	2	3	-	-	-	-	-					

Mapping Strength: 2 Strong: 3 Medium –2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	List of Events			
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.			
2	Waste management– Public, Private and Govt organization, 5 R's.			
3	Setting of the information imparting club for women leading to contribution in social and economic issues.			
4	Water conservation techniques – Role of different stakeholders– Implementation.			
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.			
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.			
7	Developing Sustainable Water management system for rural areas and implementation approaches.			

8	Contribution to any national level initiative of Government of India. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.			
9	Spreading public awareness under rural outreach programs.(minimum5 programs)			
10	Social connect and responsibilities.			
11	Plantation and adoption of plants.			
12	Govt. school Rejuvenation and helping them to achieve good infrastructure			
13	Sustainable agriculture practices - Organic farming, Agroforestry and crop rotation.			
14	Rural finance – role of local bodies, need for agricultural finance and sources of agricultural finances.			
15	Strategies for the development of rural markets and emerging issues in rural marketing			
16	Rural energy system – conventional and non-conventional, Rural electrification-policies, achievements and targets.			
17	Livestock economies - fishery and poultry development, forestry and horticulture.			
18	Role of NGO's in rural development, the role of voluntary organization in India's development processes.			
19	Issues in rural industrialization and development of agro-based industries, rural non-farm sector			
	Total No. of Lecture Hours	-	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			**26**

ONENSS – CAMP @ College /University /State or Central Govt Level /NGO's /General Social Camps

- Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp.

- CIE will be evaluated based on their presentation, approach and implementation strategies.

Suggested Learning Resource:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

Course Code: BPEK459 **Course: Physical Education (Sports & Athletics) – II**
Credits: Zero **L:T:P 0:0:2**
SEE: NA **CIE: 100 Marks**
SEE Hours: NA **Max. Marks: 100**

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

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module IV : Ethics and Moral Values **5 Hours**
A. Ethics in Sports B. Moral Values in Sports and Games
Module V : Specific Games (Any one to be selected by the student) **20 Hours** A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.
Module VI: Role of Organisation and administration **5 Hours**

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.	Assignment	50
	Total	**100**

Course Code: BYOK459 **Course: Yoga**
Credits: Zero **L:T:P 0:0:2**
SEE: NA **CIE: 100 Marks**
SEE Hours: NA **Max. Marks: 100**

Prerequisites if any	None
Learning objectives	1. To enable the student to have good health and mental hygiene. 2. To possess emotional stability 3. To integrate moral values 4. To attain higher level of consciousness.

Course Outcomes:

On successful completion of the course, the student will be able to:

	Course Outcomes	Bloom's level
CO1	Understand the meaning of Yoga, its origin, history, development and importance.	Understand
CO2	Perform various Surya namaskar and able to Teach its benefits	Apply
CO3	Perform various asanas and able to Teach its benefits	Apply
CO4	Understand Benefits of Yoga on fitness and health	Apply

Course Content

	Module – 1	No. of Lecture and Practical Hours	No. of Tutorial Sessions
1.1	Role of yoga in controlling diseases	1	-
1.2	Patanjali's Ashtanga Yoga, its need and importance.	1	-
1.3	Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha	1	-
1.4	Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan	1	-
	Module – 2		
2.1	Warmup Exercise	2	-
2.2	Yoga jogging	2	-
2.3	Suryanamaskar12 count- 4 rounds of practice	2	-
2.4	Asana its meaning by name, technique, precautionary measures and benefits of each asana.	2	-
2.5	Sitting: 1.Sukhasana 2. Paschimottanasana 3.Bharadwajasana	2	-
2.6	Standing: 1. Ardhakati Chakrasana 2. Parshva Chakrasana	2	-
2.7	Prone line: 1.Makarasana 2.Dhanurasana	2	
2.8	Supine line 1. Halasana 2. Karna Peedasana	2	
	Module – 3		
3.1	Pranayama – Suryanuloma, Chandranuloma,	2	-
3.2	Suryabhedana,Chandra Bhedana,Nadishodhana	2	-
	Total No. of Lecture and practical Hours	**24**	-
	No. of Tutorial Sessions		**Nil**

Detailed Lesson Plan

Sl. No. of Module	Number of related learning Objectives	Weeks/ Dates	Online Mode		ICT Tool/ Platform/ LMS	Face-to-face Mode		Duration in Minutes
			Resource (OER/ URL/ IM/ CP)	Activity (Describe activity in detail)		Resource (OER/ URL/ IM/ CP)	Activity	
1.1	1 & 4	W 1			PPT, SMART BOARD, MOODLE		Explanation	60
1.2	1 & 4	W 1					Explanation	60
1.3	1 & 4	W 2					Explanation	60
1.4	1 & 4	W 2					Explanation	60
1.5	1 & 4	W 3					Explanation	60
1.6	1 & 4	W 3					Explanation	60
2.1	2 & 4	W 4					Practicing Surya namaskar	60
2.2	2 & 4	W 4					Practicing Surya namaskar	60
2.3	2 & 4	W 5					Practicing Surya namaskara	60
2.4	2 & 4	W 5					Practicing Surya namaskar	60
2.5	2 & 4	W 6					Practicing Surya namaskar	60
2.6	2 & 4	W 6					Practicing Asana	60
3.1	3 & 4	W 7					Practicing Asana	60
3.2	3 & 4	W 7					Practicing Asana	60
3.3	3 & 4	W 8					Practicing Asana	60
3.4	3 & 4	W 8					Practicing Asana	60
3.5	3 & 4	W 9					Practicing Asana	60
3.6	3 & 4	W 9					Practicing Asana	60
3.7	3 & 4	W10					Practicing Asana	60
3.8	3 & 4	W10					Practicing Asana	60
3.9	3 & 4	W 11					Practicing Asana	60
3.10	3 & 4	W11					Practicing Asana	60
3.11	3 & 4	W12					Practicing Asana	60
3.12	3 & 4	W 12					Practicing Asana	60

Assessment Pattern:

Bloom's level	Continuous Internal Examination			Semester End Examination
	Test 1	Test 2	Assignment	
Remember	-	-	-	-
Understand	✓	✓	✓	✓
Apply	✓	✓	✓	✓

Suggested Learning Resources:

Text Books:

1. Yogapravesha in Kannada by Ajitkumar
2. Light on Yoga by BKS Iyengar
3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
5. Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer links

1. https://youtu.be/KB-TYlgd1wE
2. https://youtu.be/aa-TG0Wg1Ls