



ESTD: 2001
We Succeed with a Difference

RNS INSTITUTE OF TECHNOLOGY

Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi
Approved By AICTE, New Delhi. Accredited by NAAC 'A+' Grade
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Dr. B. N. Shetty
Founder



DEPARTMENT OF CSE - DATA SCIENCE

BACHELOR OF ENGINEERING

Scheme and Syllabus of III & IV Semesters

2024 SCHEME



Scheme and Syllabus Batch 2024 - 2028

(As per NEP-2020)
(Effective from the academic year 2024 – 25)

ESTD : 2001
An Institute with a Difference



RNS INSTITUTE OF TECHNOLOGY
An Autonomous Institute under VTU
Accredited with NAAC A+ Grade

Department of CSE (Data Science)

Autonomous Scheme (Effective from Academic Year 2024 – 25)



ESTD : 2001

An Institute with a Difference

About RNSIT

RNS Institute of Technology, familiar as RNSIT was established in the year 2001. It is the brainchild of Dr. R. N. Shetty, a well-known industrialist, and a great philanthropist. The institution was established with the sole purpose of imparting quality education in Engineering, Technology and Management. Being one of the premier engineering colleges in the country RNSIT is marching towards placing itself in the global map by excelling in academics and placements.

Lush green campus, state of the art infrastructure, well equipped laboratories, hundreds of activities, numerous new initiatives, consistent VTU ranks, path breaking placements, cultural extravaganza, Sports events, 5600+ students and 300 + faculty – with all these RNSIT has become dream destination for engineering aspirants across the country.

Vision

Building RNSIT into a World Class Institution

Mission

To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by

- Attracting quality Students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions
- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class Professionals with social responsibility
- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students
- Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development
- Providing freedom of action and choice for all the Stakeholders with better visibility

About CSE (Data Science)

Data Science is an offshoot of the Computer Science domain and its relevance and importance in solving today's technologically complex problems has been exponentially growing. With the present high-volume data and unstructured in many cases that is generated across domains, there is a strong need to train students in developing involved techniques in data analytics and derive intelligent inferences from these complex data. To cater to this demand, the CSE (Data Science) department was established in the academic year 2021-22. Presently, the department has an annual intake of 120 students. The department has highly qualified faculty from premier institutes in India. Many of the faculty have a very rich industry and R&D experience from within India and abroad. Students have an opportunity to involve in research during their UG and PG studies and this will pave the way for research-based career avenues for them. The high calibre teaching faculty and the excellent infrastructure creates a stimulating ambience for students to graduate to high quality data engineers and scientists.

Vision

Empowering students to solve complex real-time computing problems involving high volume multi-dimensional data.

Mission

- Provide quality undergraduate education in both theoretical and applied computer science to solve real world problems.
- Conduct research to develop algorithms that solve complex problems involving multi-dimensional high volume data through intelligent inferencing.
- Develop good linkages with industry and research organizations within India and abroad to expose students to global problems and find optimal solutions.
- Creating confident Graduates who can contribute to the nation through high levels of commitment following ethical practices and with integrity.

Programme Educational Objectives

A Graduate of CSE (Data Science) will be able to:

- Develop graduates who acquire knowledge and skills to apply the principles of Mathematics, basic Science and core computer science including data-driven analytics to solve real world inter-disciplinary problems.

- Develop graduates to pursue careers that help them to excel in the Data Science areas, to pursue entrepreneurship and also take up higher studies, all towards life-long learning.
- Develop graduates to inculcate cross-cultural appreciation, professional ethics and high levels of communication skills to apply their knowledge to solve problems of societal need.

Program Outcomes (Revised)

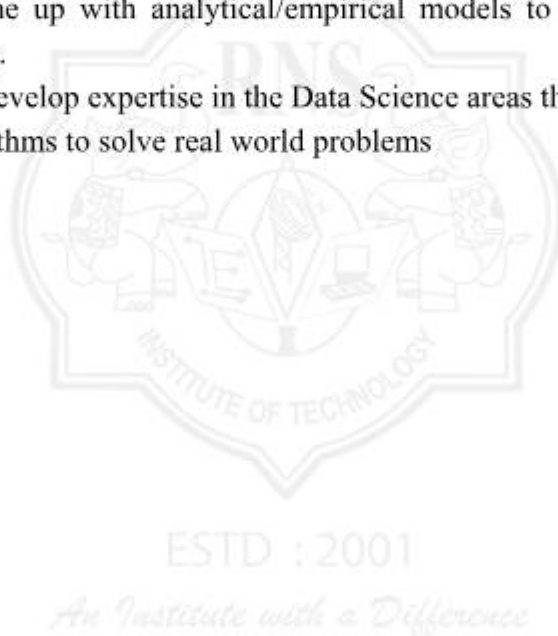
1. **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
4. **PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. **PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **PO8: Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

10. **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. **PO11: Life-Long Learning:** Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes (PSOs)

The CSE (Data Science) graduates will have

1. Graduates will develop proficiency in logical and analytical skills to solve data intensive real world problems that encompass structured and unstructured high volume data.
2. Graduates will develop abilities to analyze and unearth the inter-relationships between data elements to come up with analytical/empirical models to develop intelligent Decision Support Systems.
3. Graduates will develop expertise in the Data Science areas that help in the development of intelligent algorithms to solve real world problems



B.E. in CSE (Data Science): Autonomous Scheme and Syllabus

3 rd Semester														
SL NO	COURSE	COURSE CODE	COURSE TITLE	TD/ PSB	TEACHING HOURS PER WEEK				EXAMINATION				CREDITS	
					THEORY LECTURE (L)	TUTORIAL (T)	PRACTICAL (P)	(TW + SL)*Sem (S)	DURATION IN HOURS	CIE MARKS	SEE MARKS	TOTAL MARKS		
1	PCC	BCS301	DISCRETE MATHEMATICS AND STATISTICAL INFERENCE	CSE - CD / MATHS	3	0	0	45	3	50	50	100	3	
2	IPCC	BCS302	LOGIC DESIGN AND COMPUTER ORGANIZATION	CSE – CD	3	0	2	45	3	50	50	100	4	
3	IPCC	BCS303	OPERATING SYSTEMS	CSE – CD	3	0	2	45	3	50	50	100	4	
4	PCC	BCS304	DATA STRUCTURES AND APPLICATIONS	CSE – CD	3	0	0	45	3	50	50	100	3	
5	PCCL	BCSL305	DATA STRUCTURES LABORATORY	CSE – CD	0	0	2	0	3	50	50	100	1	
6	ESC	BXX306X	ESC/ETC/PLC (BUCKET LIST – A PROVIDED)	CSE – CD	3	0	0	45	3	50	50	100	3	
					2	0	2	30						
7	UHV	BSCK307	SOCIAL CONNECT AND RESPONSIBILITY	ANY	0	0	2	0	2	100	0	100	1	
8	AEC/ SEC	BXXX/ L358X	BUCKET LIST – B PROVIDED	CSE – CD	IF COURSE IS THEORY				2	50	50	100	1	
					1	0	0	15						
					IF COURSE IS PRACTICAL				3					
					0	0	2	0						
9	MC	BNSK359	NATIONAL SERVICE SCHEME (NSS)	ANY	0	0	2	0		100	0	100	0	
		BPEK359	PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)	PED										
		BYOK359	YOGA	PED										
	TOTAL										550	350	900	20

* TW – Term Work, SL – Self Learning

EMERGING SCIENCE COURSES / EMERGING TECHNOLOGY COURSES BUCKET LIST - A

BCS306A	OBJECT ORIENTED PROGRAMMING USING JAVA
BCD306B	UNIX SYSTEM PROGRAMMING
BCD306C	DATA ANALYTICS WITH R
BCI306D	FUNDAMENTALS OF FULL STACK DEVELOPMENT USING MERN

ABILITY ENHANCEMENT COURSES / SKILL DEVELOPMENT COURSES BUCKET LIST - B

BFLC358A	FOREIGN LANGUAGE COURSE 1- GERMAN
BFLC358B	FOREIGN LANGUAGE COURSE 1- SPANISH
BCIL358C	AI TOOLS AND APPLICATIONS
BCDL358D	DATA VISUALIZATION
BCSL358E	PROJECT MANAGEMENT WITH GIT

4 th Semester													
SL NO	COUR SE	COURSE CODE	COURSE TITLE	TD/ PSB	TEACHING HOURS PER WEEK				EXAMINATION				CREDITS
					THEORY LECTURE (L)	TUTORIAL (T)	PRACTICAL (P)	TW + SL /Sem (S)	DURAT ION IN HOURS	CIE MARKS	SEE MARKS	TOTAL MARKS	
1	PCC	BCS401	DESIGN AND ANALYSIS OF ALGORITHMS	CSE - CD	3	2	0	45	3	50	50	100	4
2	IPCC	BCS402	DATABASE MANANGEMENT SYSTEMS	CSE - CD	3	0	2	45	3	50	50	100	4
3	IPCC	BCS403	MICROCONTROLLERS AND IOT	CSE - CD	3	0	2	45	3	50	50	100	4
4	PCCL	BCSL404	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY	CSE - CD	0	0	2	0	3	50	50	100	1
5	ESC	BXX405X	ESC/ETC/PLC (BUCKET LIST – C PROVIDED)	CSE - CD / Maths	3	0	0	45	3	50	50	100	3
					2	0	2	30					
6	AEC/ SEC	BXXT/L45 6X	BUCKET LIST – D PROVIDED	CSE - CD	IF COURSE IS THEORY				2	50	50	100	1
					1	0	0	15					
					IF COURSE IS PRACTICAL				3				
					0	0	2	0					
7	BSC	BENS407/ BBOE407	ENVIRONMENTAL STUDIES / BIOLOGY FOR ENGINEERS	CIV / CSE – CD	2	0	0	30	2	50	50	100	2
8	UHV	BUHV408	UNIVERSAL HUMAN VALUES	ANY	0	0	2	0	2	50	50	100	1
9	MC	BNSK459	NATIONAL SERVICE SCHEME (NSS)	ANY	0	0	2	0	-	100	0	100	0
		BPEK459	PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)	PED									
		BYOK459	YOGA	PED									
TOTAL										550	350	900	20

NOTE: (i) 1st semester Chemistry cycle sections will study "ENVIRONMENTAL STUDIES" in 4th semester and "BIOLOGY FOR ENGINEERS" in 5th semester

(ii) 1st semester Physics cycle sections will study "BIOLOGY FOR ENGINEERS" in 4th semester and "ENVIRONMENTAL STUDIES" in 5th semester

*TW – Term Work, SL – Self Learning

EMERGING SCIENCE COURSES / EMERGING TECHNOLOGY COURSES BUCKET LIST - C	
BCS405A	LINEAR ALGEBRA
BCS405B	GRAPH THEORY
BCS405C	METRIC SPACES
BCS405D	GAME THEORY

ABILITY ENHANCEMENT COURSES / SKILL DEVELOPMENT COURSES BUCKET LIST - D	
BFAT456A	FINANCE AND ACCOUNTING
BCDL456B	MONGODB
BCSL456C	MOBILE APPLICATION DEVELOPMENT
BCIL456D	JULIA

B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – III			
Course Title:	Discrete Mathematics and Statistical Inference		
Course Code:	BCS301	CIE MARKS	50
(L :T : P) + SL	(3:0:0) + (45 Hours/Sem)	SEE MARKS	50
Credits:	3	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
The objectives of the course are to facilitate the learners to			
1. To help students to understand discrete and continuous mathematical structures. 2. To impart basics of relations and functions. 3. To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations. 4. To provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypothesis.			
Module-1			9 Hours
The Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and Proofs of Theorems.			
Textbook 1: Ch - 2.1 to 2.5			
Module-2			9 Hours
Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions.			
Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations –			
The Binomial Theorem, Combinations with Repetition.			
Textbook 1: Ch- 1.1 to 1.41, 4.1 to 4.21			
Module-3			9 Hours
Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions.			
The Pigeon-hole Principle, Function Composition and Inverse Functions.			
Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.			
Textbook 1: Ch - 5.1 to 5.3, 5.6 to 5.11			
Module-4			9 Hours
The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.			
Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.			
Textbook 1: Ch - 8.1 to 8.5, 10.1 to 10.2			
Module-5			9 Hours

Introduction to Statistical Inference, Point Estimation, Confidence Intervals, Hypothesis Testing - Basics: Null and Alternative Hypothesis, Type I and Type II Errors, z – test for large samples, t-Test (One-Sample, Two-Sample, Paired), Chi-Square Test for Independence & Goodness-of-Fit.

Textbook 1: Ch- 27.1 to 27.8

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply logical reasoning and various proof strategies (direct, contradiction, induction) to validate mathematical theorems and logical statements.
CO2	Explain and analyze discrete structures such as sets, logic, and combinatorics to identify their role in solving computational problems.
CO3	Apply and analyze relations, functions, and partially ordered sets to model and interpret discrete mathematical structures in computing systems.
CO4	Solve and evaluate recurrence relations and generating functions in the context of algorithm analysis and problem modelling.
CO5	Apply and interpret statistical estimation and hypothesis testing to assess engineering problems and evaluate conclusions using confidence intervals.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be

			for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.			

Textbooks

- Ralph P. Grimaldi:** “Discrete and Combinatorial Mathematics”, 5th Edition, Pearson Education. 2004.
- B. S. Grewal:** “Higher Engineering Mathematics”, Khanna publishers, 44th Ed., 2021.

Reference Books

- Ralph P. Grimaldi, B V Ramana:** “Discrete Mathematical Structures an Applied Introduction”, 5th Edition, Pearson Education, 2004.
- B. V. Ramana:** “Higher Engineering Mathematics” McGraw-Hill Education, 11th Ed., 2017.
- S C Gupta, V K Kapoor:** “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons Publication, 12th edition.
- H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.

Web links and Video Lectures (e-Resources):

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- <http://www.themathpage.com/>
- <http://www.abstractmath.org/>
- <http://www.ocw.mit.edu/courses/mathematics/>

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

- Quizzes
- Assignments
- Seminar



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B.E. (CSE and Allied Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	Logic Design and Computer Organization		
Course Code:	BCS302	CIE MARKS	50
(L : T : P) + SL	(3:0:2) + (45 Hours/Sem)	SEE MARKS	50
Credits:	4	EXAM HOURS	3
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Demonstrate the functionalities of binary logic system 2. Explain the working of combinational and sequential logic system 3. Realize the basic structure of computer system 4. Illustrate the working of I/O operations and processing unit			
Module-1			9 Hours
Introduction to Digital Design: Binary Logic, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates Gate Level Minimization: Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Exclusive-OR Function Hardware Description Language – Verilog Model of a simple circuit. Textbook 1: Chapter-1(1.9), Chapter-2(2.3-2.5,2.8), Chapter-3(3.1- 3.3, 3.6-3.7, 3.9, 3.11)			
Module-2			9 Hours
Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder- Subtractor, Decimal adder, Decoders, Encoders, Multiplexers. HDL (Verilog) Models of Combinational Circuits – Adder, Multiplexer, Decoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops- JK, Characteristic Tables Textbook 1: Chapter-4(4.1-4.2, 4.4-4.6, 4.9-4.12), Chapter-5(5.1-5.4)			
Module-3			9 Hours
Registers: Registers, 4 bit Register with parallel load, shift Register: 4 bit shift Register, Serial transfer, Serial Addition Counters: Ripple Counters: Design of 4-Bit Binary ripple counter using D & T Flip-flops Synchronous Counters: 4 bit Binary counter, 4 Bit Up/Down Binary counter, Design of Counter with Unused States Textbook 1: Chapter-6(6.1- 6.5)			
Module-4			9 Hours

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.

Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

Text book 2: Chapter-1(1.2-1.4, 1.6), Chapter-2(2.2-2.5)

Module-5

9 Hours

Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration. Cache memory, Mapping functions- Direct, Associative, Set-associative
Basic Processing Unit: Some Fundamental Concepts- Register Transfers, Performing ALU operations, Fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction.

Text book 2: Chapter-4(4.1, 4.2.1, 4.2.2, 4.2.3, 4.4), Chapter-5(5.5, 5.5.1), Chapter-7(7.1-7.2)

PRACTICAL COMPONENT OF IPCC

Sl. No.	EXPERIMENTS
PART A	
1	Realization of Logic gates AND, OR, NOT, NAND, NOR, XOR and XNOR using Verilog HDL
2	Given a 4-Variable logic expression, simplify it using appropriate technique and simulate the same using Basic gates in Verilog HDL.
3	Design Verilog HDL to implement simple circuits using Structural, Data flow and Behavioural model.
4	Design Verilog HDL to implement Half and Full Adder.
5	Design Verilog HDL to implement Half and Full Subtractor.
PART B	
6	Design Verilog HDL to implement 4 bit Binary Full adder, a 4 bit Binary Subtractor and simulate the same using basic gates.
7	Design Verilog HDL to implement Different types of Multiplexer - 2:1, 4:1 and 8:1.
8	Design Verilog HDL to implement Different types of De-Multiplexer- 1:2, 1:4 and 1:8
9	Design Verilog HDL for implementing various types of Flip-Flops such as JK and D
10	Design a 4 bit Ripple counter and implement with Verilog HDL
Demo Experiment	

1	Verilog implementation of AND, OR, and NOT logic gates using a MacCulloch-Pitts Perceptron model (single-layer Feedforward Neural Network).
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COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply the fundamental concepts of Binary logic, Boolean algebra, and logic gate minimization using Karnaugh Map (K-MAP) techniques.
CO2	Design and analyse Combinational and Sequential circuits.
CO3	Develop and evaluate the functionality of registers and counters.
CO4	Elaborate the fundamental structure and key performance parameters of a computer system.
CO5	Describe the concepts of Input/Output (I/O) organization and the process of instruction execution in a basic processing unit.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.

SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

1. M. Morris Mano and Michael D. Ciletti, "Digital Design with an Introduction to Verilog Design", 5th Edition, Pearson Education, 2013.
2. Carl V. Hamacher, Zvonko G. Vranesic, and Safwat G. Zaky, "Computer Organization", 5th Edition, Tata McGraw-Hill, 2002.
3. William Stallings, "Computer Organization and Architecture- designing for performance", 8th Edition, Prentice Hall, New Jersey, 2010.

Reference Books

1. M. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals", 4th Edition, Pearson Education, 2008.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design", 4th Edition, Morgan Kaufmann Publishers, 2009.
3. Anrew S. Tanenbaum, "Structured Computer Organization", 5th Edition, Pearson Education, 2006

Weblinks:

1. <https://cse02-iiith.vlabs.ac.in/>
2. <https://ocw.mit.edu/courses/6-111-introductory-digital-systems-laboratory-fall-2006/>
3. <https://circuitverse.org/>
4. <https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/>
5. NPTEL : <https://nptel.ac.in/courses/117105080>
6. NPTEL: <https://nptel.ac.in/courses/106102062>

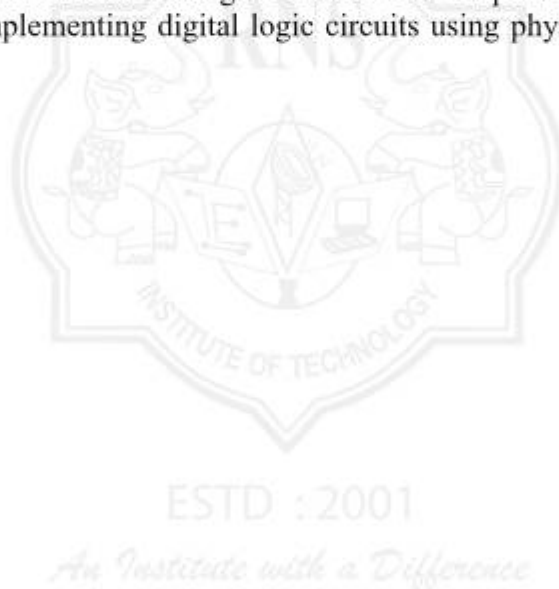
Self – Study topics:

- Finite State Machine (FSM) Design Using Verilog- Implementation of Mealy and Moore machines for real-time applications.
- RISC vs. CISC Architectures- Comparative study of instruction sets, execution efficiency, and real-world processor examples.

- Introduction to FPGA-Based Digital Design- Basics of Field Programmable Gate Arrays (FPGAs) and using HDL for hardware synthesis.
- Pipelining in CPU Design- Study of instruction pipeline stages, pipeline hazards, and performance improvement techniques.

Activity Based Learning

- Flipped Classroom
- Group Discussion (GD)
- Student Seminars
- Project Based Learning
- **Peer Teaching** - Make Groups and give crosswords related to the subject by using <https://www.ohmydots.com/creator-crossword.html>
- Hands-on Practical Session using IC Trainer Kit- To provide students with real-time exposure to implementing digital logic circuits using physical ICs and wiring on a trainer kit.



B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – III			
Course Title:	Operating Systems		
Course Code:	BCS303	CIE MARKS	50
(L :T : P) + SL	(3:0:2) + (45 Hours/Sem)	SEE MARKS	50
Credits:	4	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Understand the fundamental concepts and architecture of operating systems, including system structure, services, and system calls.			
2. Analyse and apply concepts of process, thread, and CPU scheduling, along with inter-process communication and synchronization techniques.			
3. Explain and evaluate memory management strategies, including paging, segmentation, and virtual memory techniques.			
4. Demonstrate knowledge of file systems, storage structures, and protection mechanisms, and use relevant system-level commands and APIs for managing OS resources			
Module-1		9 Hours	
Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations.			
Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure.			
Textbook 1: Chapter-1(1.1-1.5), Chapter-2(2.2-2.7)			
Module-2		9 Hours	
Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication.			
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.			
Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling.			
Textbook 1: Chapter-3(3.1-3.4), Chapter-4(4.1-4.4), Chapter-5(5.1 -5.3,5.5)			
Module-3		9 Hours	
Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization.			

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Textbook 1: Chapter-6 (6.1-6.6), Chapter-7(7.1 -7.7)

Module-4

9 Hours

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

Textbook 1: Chapter -8(8.1-8.6), Chapter 9(9.1-9.6)

Module-5

9 Hours

File System, Implementation of File System: File system: File concept; Access methods; Directory and Disk structure

Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Secondary Storage Structure, Protection: Mass storage structures; Disk structure; Disk Attachment, Disk scheduling;

Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix.

Textbook 1: Chapter-10(10.1-10.3) , Chapter-11(11.1-11.5), Chapter-12(12.1-12.4), Chapter-14(14.1-14.4)

PRACTICAL COMPONENT OF IPCC

EXPERIMENTS	
Sl. No	PART A
1.	Develop a C program to implement the Process system calls (fork (), exec (), wait(), create process, terminate process)
2.	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) Round Robin
3.	Develop a C program to simulate producer-consumer problem using semaphores.
4.	Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5.	Develop a C program to simulate the Linked file allocation strategies
6.	Develop a C program to simulate SCAN disk scheduling algorithm.
PART B (Case Study Based Learning)	

1.	CPU Scheduling – Priority, SJF, SRTF A real-time OS for a medical monitoring device needs responsive CPU scheduling for patient alerts, logging, and UI display. Questions: - Given a set of processes with burst time and priorities, simulate execution under Priority Scheduling, SJF, and SRTF. - Which algorithm ensures minimum response time for emergency alerts? Can starvation occur in any algorithm? Propose a solution
2.	Multithreading You're developing a multithreaded application for online proctoring that must record video, monitor mouse movement, and detect tab switching concurrently. Questions: - Identify tasks that can run as separate threads. - How would you manage shared resources like logs or video buffers? - Design a synchronization scheme to avoid race conditions during thread execution.
3.	Banker's Algorithm for Deadlock Avoidance An automated research lab has robotic arms (resources) allocated to multiple experiment modules (processes). The system must avoid deadlocks when assigning robotic arms. Questions: - Given a snapshot of allocated and maximum resources, apply Banker's algorithm to determine if the system is in a safe state. - What should the system do if a new module requests more resources? - Modify the scenario to include resource preemption. How does this impact safety?
4.	Dining Philosopher Problem Your company is designing an automated restaurant system where robotic arms represent philosophers sharing limited cooking utensils (forks). Questions: - How will you model the utensil access to prevent deadlocks? - If one philosopher is replaced by a "VIP" who should never wait, how would you modify your synchronization logic? - Simulate one round of execution and analyze if any philosopher starves.
5.	Contiguous Memory Allocation A company is developing an embedded system for an industrial robot. The robot's operating system must load real-time control programs into memory using

	contiguous memory allocation for speed and predictability. Questions: - The control programs vary in size. How should the OS manage memory to minimize fragmentation? - Which allocation strategy (First Fit, Best Fit, Worst Fit) would be most efficient here and why? - After 10 load-unload cycles, analyze the state of memory. How can compaction help in this scenario?
6.	Page Replacement Algorithms An educational software company is optimizing a virtual memory system for an e-learning tablet. Students often multitask between notes, browser, and video lectures. Questions: - Simulate page accesses using FIFO, LRU, and Optimal algorithms. Compare page faults. - In real-time usage, which algorithm would you implement and why? - How will the choice of algorithm impact user experience when switching apps?
7.	File Allocation A cloud storage service stores small to medium files for academic institutions. Different strategies (contiguous, linked, indexed) impact retrieval time and fragmentation. Questions: - Given a set of file sizes and disk blocks, demonstrate how each method allocates space. - Which method performs best for random access vs. sequential access? - How will the system handle file growth in each case?
8.	Directory Structure Designing a multi-user OS for a campus intranet requires an efficient and secure directory structure. Questions: - Which directory structure (single-level, two-level, tree-structured) would best suit departmental file segregation? - How would you implement access permissions for faculty vs. students? - What are the limitations of a tree-structured directory if symbolic links are introduced?
9.	Disk Scheduling Algorithms A university server handles high-volume read/write requests for students accessing online lab submissions. Questions:

	- Using a queue of 10 disk I/O requests (randomly ordered), simulate FCFS, SSTF, and SCAN algorithms. - Which algorithm minimizes seek time and why? - What trade-offs would you consider for fairness vs. efficiency?
10.	Build a simplified version of the ls command using only system calls (no standard library functions like opendir()).

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Interpret and explain the interactions among operating system components, including kernel functions, system calls, and user interfaces, within typical system operations.
CO2	Apply CPU Scheduling algorithms and process synchronization mechanisms to manage concurrent execution.
CO3	Analyse memory management techniques such as paging and segmentation to optimize memory utilization.
CO4	Evaluate file system structures and I/O management strategies to enhance overall system performance.
CO5	Simulate key operating system functionalities and system-level tasks using software tools and utilities.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.

Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “Operating System Concepts”, 8th Edition, Wiley-India, 2015.

Reference Books

1. P.C.P. Bhatt, “An Introduction to Operating Systems: Concepts and Practice”, 4th Edition, PHI(EEE), 2014.
2. William Stallings, “Operating Systems: Internals and Design Principles”, 6th Edition, Pearson.
3. A.S. Tanenbaum, H. Bos ,2014, “Modern Operating Systems”, 4th Edition, Prentice-Hall of India, New Delhi.

Weblinks

1. <https://pages.cs.wisc.edu/~remzi/OSTEP/>
2. <https://www.geeksforgeeks.org/operating-systems/reference>
3. https://www.tutorialspoint.com/operating_system/index.htm
4. <https://www.scaler.com/topics/operating-system/>
5. <https://www.youtube.com/watch?v=yK1uBHPdp30>
6. <https://www.youtube.com/watch?app=desktop&t=1s&v=dOiA2nNJpc0>

Self-Study Topics:

1. Virtual Machines

Study the concept of virtualization, including the architecture and functionality of virtual machines (VMs), and understand how VMs help in efficient resource utilization and system isolation.

2. Basic Linux Commands

Gain hands-on experience with essential Linux terminal commands used for file management, user permissions, process control, and system monitoring.

3. Multithreading Demonstration using Programming Languages

Implement and compare multithreading concepts using:

- a. Java – via Thread class and Runnable interface
- b. Python – using the threading module

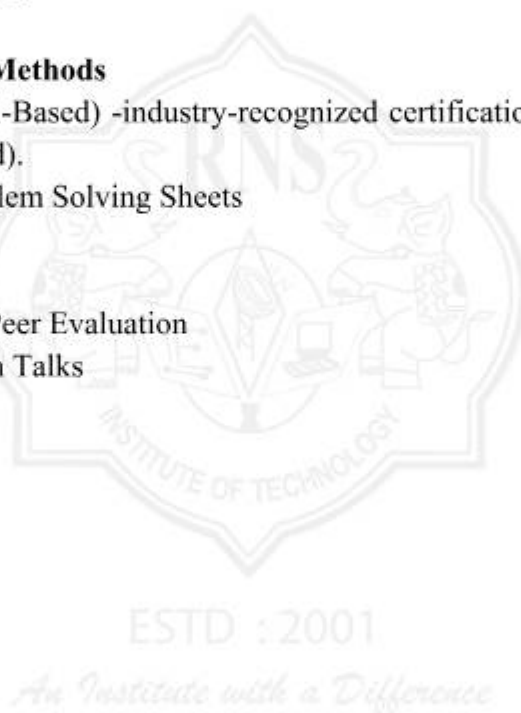
4. C Programming – using POSIX threads (pthreads)

Overview of Different Operating Systems

Compare architecture, scheduling, memory management, and file systems across these OS types: Linux, Windows, Unix, Android, MacOS, iOS, RTOS, Chrome OS, Solaris, Haiku OS, TinyOS

Alternate Assessment Methods

1. Certifications (Skill-Based) -industry-recognized certifications (e.g. CISCO, NPTEL, Infosys Springboard).
2. Assignments / Problem Solving Sheets
3. Quiz
4. Mini Projects
5. Group Activities / Peer Evaluation
6. Presentations / Tech Talks



B.E. (CSE and Allied Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	Data Structures and Applications		
Course Code:	BCS304	CIE MARKS	50
(L :T : P) + SL	(3:0:0) + (45 Hours / Sem)	SEE MARKS	50
Credits:	3	EXAM HOURS	3
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Explain the fundamental concepts, classifications, and operations of data structures. 2. Implement arrays, pointers, and strings for efficient data representation and manipulation. 3. Apply linear data structures such as stacks, queues, and linked lists to solve problems. 4. Construct and traverse non-linear data structures including trees and graphs. 5. Utilize advanced data structures like hashing and balanced trees to design optimized solutions.			
Module-1			9 Hours
Introduction To Data Structures: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Review of pointers and dynamic Memory Allocation			

Arrays and Structures: Arrays, Sorting using arrays: Insertion sort, Radix sort, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings

Textbook 1: Chapter-2 (2.4-2.5)

Textbook 2: Chapter-2 (2.1-2.3), Chapter-3 (3.1-3.13), Chapter-4 (4.1-4.4), Chapter-5 (5.1-5.8), Chapter-14(14.8-14.12)

Module-2

9 Hours

Stacks: Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions, Recursion

Queues: Queues, Circular Queues using Dynamic Arrays, Priority Queue, Multiple Stacks and queues.

Textbook 1:Chapter-3 (3.1- 3.7)

Module-3

9 Hours

Linked Lists: Singly Linked, Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List Operations, Sparse Matrices, Doubly Linked List.

Textbook 1:Chapter-4 (4.1- 4.5, 4.7-4.8)

Module-4

9 Hours

Trees: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees., Binary Search trees, Selection Trees, Forests.

Textbook 1:Chapter-5 (5.1-5.3, 5.5, 5.7-5.9)

Module-5

9 Hours

Multiway Search Trees: B-Trees, B+-Trees

Graphs: The Graph Abstract Data Types, Elementary Graph Operations.

Hashing: Introduction, Static Hashing, Dynamic Hashing

Textbook 1: Chapter-6 (6.1-6.2), Chapter -8 (8.1 - 8.3), Chapter -9 (9.1-9.2), Chapter -11(11.2,11.3)

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Implement fundamental data structures and perform operations using arrays, pointers, and strings.
CO2	Apply stacks and queues to evaluate expressions and solve linear data structure problems.
CO3	Develop memory-efficient programs using singly and doubly linked lists.
CO4	Construct and traverse tree-based structures to model and analyse hierarchical relationships.
CO5	Design solutions using graphs, balanced trees, and hashing techniques to address real-world computational problems.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Continuous and Comprehensive Evaluation (B)

Component	Weightage	Evaluation Method
HackerRank / LeetCode Problems	10 Marks	- Solve 2–3 DS problems per module. - Submit screenshots + short explanation. - Marks based on test cases passed + clarity.
MOOC Certification	10 Marks	- Complete an approved MOOC (NPTEL / Coursera / edX). - Submit certificate + short reflective report. - Marks based on completion
Total	20 Marks	Alternate Assessment (CIE)

Textbooks

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2014.

2. Reema Thareja, “Data Structures using C”, 2nd Edition, Oxford press, 2014.

Reference Books

1. Seymour Lipschutz, “Data Structures Schaum's Outlines”, Revised 1st Edition, McGraw Hill, 2014
2. Gilberg & Forouzan, “Data Structures: A Pseudo-code approach with C”, 2nd Edition, Cengage Learning, 2014
3. Jean-Paul Tremblay & Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, McGraw Hill, 2013
4. A M Tanenbaum, “Data Structures using C”, PHI, 1989

Web links and Video Lectures (e-resources):

1. https://youtu.be/S47aSEqm_0I?si=34alu47wCWGdsxwN
2. <https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html>
3. <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html>
4. <https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html>
5. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>
6. <https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html>
7. <https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html>
8. https://onlinecourses-archive.nptel.ac.in/noc18_cs25/preview

Self-Study Topics:

Recursion, AVL Trees, Red Black Trees.

Activity Based Learning: The following is shown as examples only but not limited to:

1. LeetCode - The World's Leading Online Programming Learning Platform
2. HackerRank - Online Coding Tests and Technical Interviews

ESTD : 2001

An Institute with a Difference



B.E. (CSE and Allied Branches) Outcome Based Education (OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	Data Structures Laboratory		
Course Code:	BCSL305	CIE MARKS	50
L :T : P	0:0:2	SEE MARKS	50
Credits:	1	EXAM HOURS	3
COURSE LEARNING OBJECTIVES: The purpose of the course is to facilitate the learner to: 1. Understand and implement dynamic memory management techniques in C. 2. Apply linear data structures (stacks, queues, linked lists) to solve computational problems. 3. Analyse and utilize non-linear data structures such as trees and graphs for applications. 4. Design practical solutions to real-world problems using suitable data structures.			
Program 1 – Weekly Planner			

A student needs a simple Weekly Planner System to keep track of their weekly schedule. For each day, the planner should store: name of the day (e.g., Monday, Tuesday...), date of the day (numeric format) and the activity planned for that day (e.g., class, event, meeting).

Develop a C program to implement this weekly planner using the following functions.

- create() to initialize the weekly planner.
- read() to input the details (day name, date, activity) from the user.
- display() to generate and print the Weekly Activity Report on screen.

Program 2 –Pattern Matching

A publishing company is developing a simple tool to edit documents by replacing certain words or phrases. Design a C program that performs find-and-replace operations on text without using built-in string functions.

- Read a main string (STR), a pattern string (PAT), and a replacement string (REP) from the user.
- Search the main string for all occurrences of PAT.
- Replace every occurrence of PAT in STR with REP.
- If PAT does not exist in STR, display an appropriate message.

Program 3- Parcel Storage System

A courier office needs a simple Parcel Storage System to manage parcels efficiently. Each parcel is assigned an integer ID for identification. Design a C program that supports the following operations:

- push() – Add a parcel ID onto the stack when a new parcel arrives.
- pop() – Remove the last parcel ID from the stack when a parcel is taken out.
- display() – Show all parcel IDs currently stored in the stack.
- Display suitable messages when the stack is full (overflow) or empty (underflow).

Program 4 - Calculator Application

In modern calculators, mathematical expressions are usually entered in infix notation, where operators are written between operands (e.g., $3 + 4 * 2$). However, calculators and computer systems evaluate these expressions more efficiently in postfix notation, where operators follow operands (e.g., $3\ 4\ 2\ *\ +$).

To simulate this process, develop a C program that converts any valid infix expression into its equivalent postfix expression. The program should support alphanumeric operands and the following operators: -, +, *, /, %, ^.

Program 5 - Call Center Help Desk

A call center assigns a ticket number to every incoming call. Since only a limited number of calls can be handled at a time, the calls are placed in a queue. When a representative becomes free, the next call in the queue is served.

Design and implement a C program to simulate this system using a circular queue. The program should support the following operations:

- Add a new call to the queue (enqueue)
- Serve the next call (dequeue)
- Display all waiting calls

The program must also handle queue overflow and underflow conditions properly.

Program 6 - Student Information Management System

A university wants to maintain a dynamic record of its students for academic and administrative purposes. Each student record contains the following details: **USN, Name, Programme, Semester, and Phone Number**. Since the number of students may vary frequently due to admissions and withdrawals, a **singly linked list (SLL)** is chosen for efficient memory usage and flexible data management.

To simulate this system, develop a **menu-driven C program** that performs the following operations on the student database:

- Create** a Singly Linked List of N student records using **front insertion**.
- Display** all student records and **count** the number of nodes in the list.
- Insert** or **delete** a student record at the **end** of the list.
- Insert** or **delete** a student record at the **front** of the list (demonstrating **stack operations**).

Program 7 - Employee Record Management System

A company maintains details of its employees for administrative and payroll purposes. Each employee record contains the following fields: **SSN, Name, Department, Designation, Salary, and Phone Number**. Since employees may frequently join, leave, or change positions, a Doubly Linked List (DLL) provides a flexible way to manage these records efficiently in both directions.

To simulate this process, design and implement a menu-driven C program that performs the following operations on the employee database:

- Create a Doubly Linked List of N employee records using end insertion.
- Display all employee records and count the total number of nodes.
- Insert or delete an employee record at the end of the list.
- Insert or delete an employee record at the front of the list.
- Demonstrate how the DLL can be used as a Double Ended Queue (Deque).

Program 8 – Library Book Management System

Design and implement a menu-driven C program to manage a Library Book Database using a Binary Search Tree (BST). Each record should store the following details: ISBN Number and Book Title.

The program should support the following operations:

- Insert a new book into the BST
- Traverse the BST using Inorder, Preorder, and Postorder
- Search for a book by its ISBN number and print the title.

Program 9 - City Connectivity using Graph Traversal

In a city transportation system, each city can be represented as a node and the direct roads between them as edges of a graph. To analyse connectivity, it is important to know which cities can be reached from a given starting city.

Develop a C program to:

- Represent N cities using an Adjacency Matrix
- Display all cities reachable from a specified city using DFS or BFS traversal

Program 10 - Collision Handling in Vehicle Registration System

In a vehicle registration system, each vehicle is assigned a unique 4-digit registration number. To support quick storage and retrieval, these records are organized in a hash table with m storage locations.

Develop a C program to:

- Store vehicle registration numbers in the hash table using linear probing and quadratic probing for collision handling.
- Display the final state of the hash table after all insertions.

Mini Project

- Students must form teams of 2 to 3 members.
- Each team must identify and finalize a real-world problem that can be solved using appropriate data structures.
- Teams must analyze the problem and design the solution using suitable data structures such as arrays, stacks, queues, linked lists, trees, or graphs.
- The project must be implemented entirely in C language.
- Modular programming practices, file handling, and inclusion of at least one innovative or optimized component are mandatory.
- The complete project including source code, README file with instructions, and sample output screenshots must be uploaded to a public GitHub repository.
- A mini project report (soft bound) must be prepared and submitted as per department guidelines.
- Teams will present their project and undergo a viva voce as part of the final evaluation

- Smart India Hackathon : [Smart India Hackathon \(sih.gov.in\)](http://sih.gov.in)
- ISRO Hackathon: [Launching of Bharatiya Antariksh Hackathon-2025 \(isro.gov.in\)](http://isro.gov.in)
- DRDO Hackathon: [Dare to Dream 5.0 Innovation Contest | Defence Research and Development Organisation - DRDO, Ministry of Defence, Government of India](http://drdo.gov.in)

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Implement and demonstrate operations on fundamental data structures
CO2	Develop programs to solve problems using linear and non-linear data structures.
CO3	Apply dynamic allocation and optimizing resource usage.
CO4	Design and implement practical solutions for real-world problems using appropriate data structures.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

B.E. CSE (Data Science)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – III			
Course Title:	Object Oriented Programming using Java		
Course Code:	BCS306A	CIE MARKS	50
(L: T: P) + SL	(2:0:2) + (30 Hours/Sem)	SEE MARKS	50
Credits:	3	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Identify and recall core OOP concepts and Java language features.			
2. Configure the Java development environment and execute simple Java programs.			
3. Develop multi-threaded Java applications using synchronization methods.			
4. Design interactive Java applications using event-driven programming principles			
Module-1		6 Hours	
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.			
Textbook 1: Chapter-6, Chapter-7			
Module-2		6 Hours	
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.			
Textbook 1: Chapter-8			
Module-3		6 Hours	
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.			
Textbook 1: Chapter-10			
Module-4		6 Hours	
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.			
Textbook 1: Chapter-11			
Module-5		6 Hours	

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, modifying a String, Changing the Case of Characters Within a String, Joining Strings.

Textbook 1: Chapter-18

PRACTICAL COMPONENT

Sl. No.	Experiments
1	Develop a JAVA program to add TWO matrices of suitable order N (The value of N should be read from command line arguments).
2	Develop a stack class to hold a maximum of 10 integers with suitable methods. Develop a JAVA main method to illustrate Stack operations.
3	A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary (percent) increases the salary by the given percentage. Develop the Employee class and suitable main method for demonstration
4	Develop a JAVA program to create a class named shape. Create three sub classes namely: circle, triangle and square, each class has two member functions named draw () and erase (). Demonstrate polymorphism concepts by developing suitable methods, defining member data and main program.
5	Develop a JAVA program to create an abstract class Shape with abstract methods calculateArea() and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
6	Develop a JAVA program to create an interface Resizable with methods resizeWidth(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
7	Develop a JAVA program to create an outer class with a function display. Create another class inside the outer class named inner with a function called display and call the two functions in the main class.
8	Develop a JAVA program to raise a custom exception (user defined exception) for DivisionByZero using try, catch, throw and finally.
9	Write a program to illustrate creation of threads using runnable class. (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
10	Implement a JAVA program to illustrate the use of different types of character extraction, string comparison, string search and string modification methods.
11	Develop a Java application that checks whether a given string is a palindrome, designed using the SOLID principles of object-oriented programming.

12	Develop a Java application that compresses characters in a given string by counting consecutive repeated characters, designed according to the SOLID principles of object-oriented programming. Input: AAABBBCCCC Output: A3B3C4
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COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Interpret Java classes with appropriate data members and methods to address specified scenarios.
CO2	Apply the concept of inheritance to model and solve real-world programming problems.
CO3	Demonstrate the effective use of multi-threading and exception handling to manage concurrency and runtime issues in Java programs.
CO4	Demonstrate the use of string handling methods to manipulate and process textual data in Java.
CO5	Develop Java programs integrating object-oriented concepts to address computational problems effectively.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE-IA Tests(A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.

CIE: Theory + Practical (A+B+C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the ESC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

- Herbert Schildt, "The Complete Reference", 12th Edition, McGraw-Hill.

Reference Books

- E Balagurusamy, "Programming with Java", 6th Edition, McGraw Hill.
- Bruce Eckel, "Thinking in Java", 4th Edition, Prentice Hall.

Web links and Videos:

- <https://www.youtube.com/watch?v=5gWpVJc0UG4>
- <https://www.youtube.com/watch?v=-HafzawNIUo>
- <https://www.youtube.com/watch?v=K3g4srbkUNM>
- <https://www.youtube.com/watch?v=iUzvdDuAeSQ>

Self-Study Topics:

SOLID Principles-GFG

Activity Based Learning:

- Leet code
- Practical or programming assignment
- Seminar/Project

B.E. CSE (Data Science)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER –III			
Course Title	Unix System Programming		
Course Code	BCD306B	CIE MARKS	50
(L: T : P) + SL	(2:0:2) + (30 Hours/Sem)	SEE MARKS	50
Credits	03	EXAM HOURS	03
COURSE LEARNING OBJECTIVES: The purpose of the course is to facilitate the learner's ability to:			
1. Demonstrate the basics of Unix concepts and commands			
2. Explore the UNIX file system			
3. Apply commands to reflect changes in file system.			
4. Explore process environment and Apply process control functions			
5. Design & develop application/service over a UNIX system.			
MODULE – 1		6 Hours	
Introduction: Unix Components/Architecture, Features of Unix, POSIX and Single UNIX specification, Understanding man documentation.			
Basic Commands: cal, date, echo, printf, bc, script, passwd, who, uname, tty, sty.			
File attributes and permissions: ls command with options, File ownership, File permissions, chmod: changing file permissions, Directory permissions, Changing file ownership			
Textbook-1: Ch 2.1-2.3,2.9; Ch-3.1-3.6, 3.9-3.13; Ch-6.1, 6.3-6.7			
MODULE – 2		6 Hours	
The Shell interpretive cycle: shell offerings, Pattern Matching-Wild cards, Three standard files and redirection.			
Shell Programming: Shell Scripts, Command line arguments, Read and read only commands, exit and exit status of a command, Logical operators for conditional execution, The if, test, case, expr, calling script by different names, while, for, The set and shift, Here document, trap, Simple shell program examples.			

Textbook-1: Ch 8.1 to 8.3, 8.5; Ch-14.1 – 14.15

MODULE – 3

6 Hours

Unix standardization and Implementations: Introduction, UNIX standardization, UNIX System Implementation.

File I/o: Introduction, File Descriptors, open, creat, close, lseek, read, write, fcntl

Files and Directories: Introduction, stat, fsat and lstat functions, access and umask functions, chmod and fchmod functions, link, unlink, remove and rename functions, symbolic links.

Textbook-2: Chapter 2.1 to 2.3; Ch-3.1-3.8, 3.14; Ch 4.1-4.2, 4.7 to 4.9, 4.15 & 4.16

MODULE – 4

6 Hours

Process Environment: Introduction, main function, Process Termination, Command-line arguments, Environment list, Memory Layout of a C program, Shared Libraries, Memory allocation, Environment Variables, setjmp and longjmp functions.

Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, race condition, exec function

Textbook-2: Chapter 7.1 – 7.11; Ch 8.1 – 8.6, 8.9 - 8.10

MODULE – 5

6 Hours

Signals: Signal concepts, signal function, SIGCLD semantics, Kill and raise functions, alarm and pause functions.

Interprocess Communication: Introduction, Pipes, popen and pclose Functions, FIFO, Semaphores.

Textbook-2: 10.1 – 10.3, 10.7, 10.9-10.10; Ch-15.1-15.3, 15.8

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Explain the architecture, components, and essential commands of the UNIX system.
CO2	Develop shell scripts to automate tasks using variables, conditions, loops, and case structures.

CO3	Demonstrate file and directory handling using system calls in C on a UNIX platform.
CO4	Implement process creation, execution, and termination using <code>fork()</code> , <code>exec()</code> , and related system calls.
CO5	Design programs to handle signals and inter-process communication (IPC) using pipes, FIFOs, and semaphores.

PRACTICAL COMPONENT

Program 1. Server Maintenance Log Access

Problem: You're a system administrator maintaining server logs. You need to regularly check the system date, calendar, user details, and modify file permissions of logs for backup and auditing.

Task: Write shell commands and scripts using `cal`, `date`, `who`, `uname`, `ls -l`, `chmod`, `chown` to:

- List files with permissions
- Modify access to logs
- Display current users and system info

Program 2. Shell Scripting-Mobile Recharge Kiosk – Plan Selector

Problem: At a prepaid recharge kiosk, the system must help the user select from available plans.

Task: Write a shell script using `case` that displays:

1. Data Plan
2. Talktime Plan
3. SMS Plan

Based on user choice, display plan details.

Program 3. User Profile Creator

Problem: You are building a script for a user account system where user details are taken and verified.

Task: Write a shell script to:

- Read a username and age
- If age ≥ 18 , print "User is eligible"
- Else, print "User is not eligible"

Program 4. COVID Daily Case Tracker

Problem: A script is needed to read a file `covid_cases.txt` containing daily cases and provide statistics.

Task: Write a shell script to:

- Count the number of lines (days reported)
- Total number of cases (using `awk`, `cut`, or `wc`)
- Display statistics using `echo` and redirection

Program 5. Intelligent Power Saver Calculator

Problem: A company wants a utility to calculate and analyze power usage savings based on different logic.

Task: Write a shell script to:

- Take 3 values: watts saved, hours used, cost per kWh
- Calculate cost saved = watts × hours × cost
- Use `if` and arithmetic expressions

Program 6. File I/O in C Secure Document Archival System

Problem: You are creating a tool to copy confidential documents to an archive safely.

Task: Write a C program using `open`, `read`, `write`, `close` to:

- Read data from `report.txt`
- Copy it into `archive/report_backup.txt`

Program 7. Process Environment and Control Student Submission Checker

Problem: You need a program that creates a child process to scan submitted files and report back.

Task: Write a C program using `fork()`:

- Parent: waits for child
- Child: lists files in `submissions/`
- Print parent and child PIDs

Program 8. Signals and IPC Signal-Driven Temperature Monitor

Problem: A lab temperature sensor raises a signal when the limit is crossed.

Task: Write a C program that:

- Catches `SIGINT`
- Prints "Temperature limit reached. Taking action..."
- Waits using `pause()`

Program 9. Client-Server Chat Using Pipes

Problem: Build a basic one-way chat system using parent-child processes.

Task: Write a C program using `pipe()`:

- Parent reads a message
- Child receives and prints it

Program 10. Print Job Queue Using FIFO

Problem: Design a print queue system where multiple users send print jobs.

Task: Write two programs:

- **Writer:** Simulates a user sending a print job using a named FIFO
- **Reader:** Simulates the printer picking jobs from FIFO

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
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Textbooks

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill.
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition. Pearson.

Reference Books

1. Terrence Chan, Unix System Programming Using C++, PHI, 1999.
2. Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley, 2014. Hall of India

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

- Build a Shell level Application on UNIX system



B.E. CSE (Data Science)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – III			
Course Title:	Data Analytics with R		
Course Code:	BCD306C	CIE MARKS	50
(L :T : P) + SL	(2:0:2) + (30 Hours / Sem)	SEE MARKS	50
Credits:	3	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. To Gain the knowledge of R Programming Concepts			
2. To Explain the concepts of Data Visualization			
3. To Explain the concept of Statistics in R.			
4. To Work with R charts and Graphs			
Module-1		6 Hours	
Introduction to R programming: Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors.			
Textbook 1 : Chapter-1(1.1-1.7),Chapter -2(2.1-2.2)			
Module-2		6 Hours	
Data Structures in R : Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times ,Time Zones, Calculations with Dates and Times.			
Data Preparation: Datasets, Importing and Exporting files, Accessing Databases, Data Cleaning and Transformation.			
Textbook 1: Chapter 2(2.3-2.8), (2.8.1-2.8.4), Chapter 3 (3.1-3.4)			
Module-3		6 Hours	
Charts, Plots, and Visual Tools for Understanding Data Patterns: Graphics using R , Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages.			
Textbook 1: Chapter 4 (4.1-4.9)			
Module-4		6 Hours	
Statistical Analysis Using R: Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance.			
Textbook 1: Chapter 5 (5.1, 5.3, 5.4-5.6.1, 5.7)			
Module-5		6 Hours	
Data Mining and Pattern Discovery Using R: Packages for Data Mining, Clustering using R,K means Clustering, Classification-Packages and functions for classification, Decision Tree, Outlier detection Using R.			
Textbook 1: Chapter 6 (6.1,6.2.2,6.3,6.3.2,6.5,6.5.2-6.5.4)			

PRACTICAL COMPONENT

Program 1. Introduction to R Programming: Data Types, Operations, and Basic Data Structures

Demonstrate the steps for installation of R and R Studio. Perform the following:

- Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.
- Demonstrate Arithmetic and Logical Operations with simple examples.
- Demonstrate generation of sequences and creation of vectors.
- Demonstrate Creation of Matrices
- Demonstrate the Creation of Matrices from Vectors using Binding Function.
- Demonstrate element extraction from vectors, matrices and arrays.

Program 2. Financial Performance Analysis in R using Vectors: Monthly Profit Evaluation and Reporting

Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:

- Profit for each month.
- Profit after tax for each month (Tax Rate is 30%).
- Profit margin for each month equals to profit after tax divided by revenue.
- Good Months – where the profit after tax was greater than the mean for the year.
- Bad Months – where the profit after tax was less than the mean for the year.
- The best month – where the profit after tax was max for the year.
- The worst month – where the profit after tax was min for the year.

Note: a. All Results need to be presented as vectors, b. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points ,c. Results for the profit margin ratio need to be presented in units of % with no decimal point,d. It is okay for tax to be negative for any given month (deferred tax asset) ,e. Generate CSV file for the data.

Program 3. Matrix Operations in R: Implementation of Basic Arithmetic and Transpose on 3x3 Matrices

Develop a program to create two 3 X 3 matrices A and B and perform the following operations

- Transpose of the matrix
- addition
- subtraction
- multiplication
- Division

Program 4. Prime Number Generation in R Using Sieve of Eratosthenes with Functions

Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.

Program 5. Leap Year Checker in R Using Conditional Statements

Implement R script to check the given year is leap year or not.

Program 6. String Manipulation in R: Exploring Text Processing Functions

Implement different String Manipulation functions in R.

Program 7. Correlation Analysis and Visualization Using the 'mammals' Dataset in R

The built-in data set mammals contain data on body weight versus brain weight.

Develop R commands to:

- Find the Pearson and Spearman correlation coefficients. Are they similar?
- Plot the data using the plot command.
- Plot the logarithm (log) of each variable and see if that makes a difference.

Program 8. Data Frame Creation, Sub-setting, and Merging in R for Inventory Analysis

Develop R program to create a Data Frame with following details and do the following operations.

- Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.
- Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies”
- Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames

itemCode	itemCategory	itemPrice
1001	Electronics	700
1002	Desktop Supplies	300
1003	Office Supplies	350
1004	USB	400
1005	CD Drive	800

Program 9. Customized Histogram Visualization in R Using the 'airquality' Dataset

Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.

- Assigning names, using the air quality data set.
- Change colors of the Histogram

- c) Remove Axis and Add labels to Histogram
- d) Change Axis limits of a Histogram
- e) Add Density curve to the histogram

Program 10. Employee Data Analysis in R: Importing, Filtering, and Exporting CSV Files

Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.

- a) Find the total number rows & columns
- b) Find the maximum salary
- c) Retrieve the details of the employee with maximum salary
- d) Retrieve all the employees working in the IT Department.
- e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv".

Program 11. Descriptive Statistics and Correlation Analysis of the 'mtcars' Dataset in R

Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following:

- a) What is the total number of observations and variables in the dataset?
- b) Find the car with the largest hp and the least hp using suitable functions
- c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?
- d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations.
- e) Which pair of variables has the highest Pearson correlation?

Program 12. Simple Linear Regression in R: Modeling Salary Progression with Experience

Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and

coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the Structures of R Programming.
CO2	Illustrate the Basics of Data Preparation Using Real-World Examples.
CO3	Apply Graphical Packages in R for Data Visualization.
CO4	Apply Various Statistical Analysis Methods for Data Analytics.
CO5	Integrate R with Machine Learning Libraries for Predictive Analytics.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.(Mini projects and presentation).
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

1. G. Sudhamathy and C. Jothi Venkateswaran, "R Programming: An Approach to Data

Analytics”, MJP Publishers, 2019

Reference Books

1. Cotton, R, “Learning R: A Step-by-Step Function Guide to Data Analysis”. 1st Edition, O’Reilly Media Inc, 2013
2. W. N. Venables, D.M. Smith and the R Development Core Team, “An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics”, Ver 3.0.1 (2013-05-16)

Web links and Video Lectures (e-Resources):

1. <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>
2. http://www.tutorialspoint.com/r/r_tutorial.pdf 3.
3. https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
4. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html 5.
5. https://www.w3schools.com/r/r_stat_data_set.asp
6. <https://rpubs.com/BillB/217355>

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

- Project based Assignment

B.E. CSE (Data Science)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – III			
Course Title	Fundamentals of Full Stack Development using MERN		
Course Code	BCI306D	CIE MARKS	50
(L: T: P) + SL	(2:0:2) + (30 Hours/Sem)	SEE MARKS	50
Credits	03	EXAM HOURS	03
COURSE LEARNING OBJECTIVES			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. To understand the fundamentals of web technologies and the structure of web applications using HTML, CSS, and JavaScript. 2. To familiarize with the MERN stack architecture and its components including MongoDB, Express.js, React, and Node.js. 3. To develop backend services using Node.js and Express.js, and integrate MongoDB for database operations. 4. To build dynamic and responsive user interfaces using react, managing state and navigation. 5. To design and develop full-stack web applications with advanced features like authentication, payments, and multimedia integration.			
Module-1		6 Hours	
Introduction to Web Development: Overview of Web Technologies, Frontend Technologies: HTML, CSS, And JavaScript Basics: Introduction, Basics, Variables, String Manipulation, Mathematical Functions, Statements, Operators, Arrays, Functions.			
Textbook-1: Chapter 1: Introduction to Web Programming (Pages 45–93), Chapter 2: Introduction to HTML (Pages 96–133), Chapter 4: Introduction to CSS (Pages 139–191)			
Module-2		6 Hours	
Introduction to JavaScript Basics: Introduction, Basics, Variables, String Manipulation, Mathematical Functions, Statements, Operators, Arrays, Functions.			
Textbook-2: Chapter 6: JavaScript Basics (Pages 274–326)			
Module-3		6 Hours	
Introduction to MERN Stack Development: Overview of the MERN stack (MongoDB, Express.js, React, Node.js), Setting up the development environment, Creating a basic MERN application skeleton.			
Backend Development with Node.js, Express.js, and MongoDB: Building a backend with Node.js and Express, Implementing RESTful APIs, Integrating MongoDB for data storage, User authentication and authorization using JWT.			
Textbook-2: Chapter 1, Chapter 3			

Module-4	6 Hours
Frontend Development with React: Building a React frontend, Managing state with React hooks, Implementing React Router for navigation, Connecting the frontend to the backend APIs.	
Textbook-2: Chapter 4	
Module-5	6 Hours
Advanced Features and Applications: Developing a social media application, Building an online marketplace with shopping cart and Stripe payments, Creating a media streaming application using MongoDB GridFS.	
Textbook-2: Chapter 5, 6 & 8	

PRACTICAL COMPONENT

Sl. No.	Experiments
1	Using MongoDB, create a collection called transactions in database usermanaged (drop if it already exists) and bulk load the data from a json file, transactions.json b. Upsert the record from the new file called transactions_upsert.json in Mongoddb.
2	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment.Total in all records.
3	a. Write a program to check request header for cookies. b. write node.js program to print the a car object properties, delete the second property and get length of the object.
4	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongoddb b. For a partial name given in node js, search all the names from mongoddb student documents created in Question(a)
5	Implement all CRUD operations on a File System using Node JS

6	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
7	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)
8	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
9	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
10	Develop a React code to collect data from rest API.

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Design and develop responsive web pages using HTML5, CSS3, and basic JavaScript functionality. <i>(Bloom's Level: L3 – Apply)</i>
CO2	Explain the structure and advantages of the MERN stack and set up the development environment. <i>(Bloom's Level: L2 – Understand)</i>
CO3	Create RESTful APIs using Node.js, Express.js, and perform CRUD operations on MongoDB with secure authentication. <i>(Bloom's Level: L3 & 4– Apply & Analyze)</i>
CO4	Build a fully functional frontend using React with routing and state management features. <i>(Bloom's Level: L3 – Apply)</i>

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
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Textbooks

1. Randy Connolly and Richardo Hoar, “**Fundamentals of Web Development**”, Pearson, 1st Edition, 2014.
2. Shama Hoque, “Full-Stack React projects”, Packt, 2018.

Reference Books

1. Vasan Subramanian Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress; 1st ed. edition (1 April 2017)

B.E. (Common to All Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	Social Connect and Responsibility		
Course Code:	BSCK307	CIE MARKS	100
L :T : P	0:0:2	SEE MARKS	-
Credits:	1	EXAM HOURS	-
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Provide a formal platform for students to communicate and connect to the surrounding. 2. Create a responsible connection with the society. 3. Understand the community in general in which they work. 4. Identify the needs and problems of the community and involve them in problem – solving. 5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems. 6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.			
General Instructions - Pedagogy: These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. 1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills. 2. State the need for activities and its present relevance in the society and provide real-life examples. 3. Support and guide the students for self-planned activities. 4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field. 5. Encourage the students for group work to improve their creative and analytical skills.			
Module-1			3 Hours
Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE students. (ONE STUDENT- ONE TREE). Students can prepare either a Report or a Poster describing the plant's origin, its usage in daily life, its appearance in folklore and literature.			
Module-2			3 Hours

Heritage walk and crafts corner

Heritage walk- Heritage tour, knowing the history and culture of the city, connecting to people around through their history.

crafts corner- Knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.

Module-3

3 Hours

Organic farming and waste management

Organic Farming: History of organic farming, objective of organic farming, types of organic farming, Usefulness of organic farming.

Waste Management: Study of wet waste management in college, Hostel and neighboring villages, and implementation in the campus.

Module-4

3 Hours

Water conservation

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.

Module-5

3 Hours

Food walk

City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Course outcomes

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

CO1	Communicate and connect to the surrounding
CO2	Create a responsible connection with the society
CO3	Involve in the community in general in which they work.
CO4	Notice the needs and problems of the community and involve them in problem-solving
CO5	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Assessment Details for CIE (both CIE and SEE)

Weightage	CIE – 100%	- Implementation strategies of the project. - The last report should be signed by SCR Coordinator, the HOD
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	

Case study-based Assessment Individual performance with report	20 Marks	and Principal. • At last report should be evaluated by the SCR Coordinator. • Finally, the consolidated marks sheet should be sent to the CoE/ university and to be made available at LIC visit.
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student at the end of semester with Report. Activities 1 to 5, 5*5 = 25	25 Marks	
Total marks for the course in each semester	100 Marks	
For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.		
There should be positive progress in the vertical order for the benefit of society in general through activities.		

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below:

Excellent	: 80 to 100
Good	: 60 to 79
Satisfactory	: 40 to 59
Unsatisfactory and fail	: <39

SPECIAL NOTE: NO SEMESTER END EXAM (SEE) – COMPLETELY PRACTICAL AND ACTIVITIES-BASED EVALUATION

ACTIVITIES

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversion will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

DURATION

A total of 30 - 35 hours engagement per semester is required for the 3rd semester of the B.E./B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentors. Faculty mentors will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus.

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. No	Topic	Group size	Location	Activity Execution	Reporting	Evaluation of the Topic
1.	Plantation and adoption of a tree:	May be individual or team of 5	Farmers land/ parks / Villages / roadside/ community area / College 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 Faculty
2.	Heritage walk and crafts corner:	May be individual or team of 5	Temples / monumental places / 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 Faculty
3.	Organic farming and waste management:	May be individual or team of 5	Farmers land / parks / Villages visits / roadside/ community area / College campus etc.....	Group 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 Faculty

4.	Water conservation: & conservation techniques	May be individual or team of 5	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 Faculty
5.	Food walk: Practices in society	May be individual or team of 5	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Group 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 Faculty

Plan of Action (Execution of Activities)

SL NO	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Execution of Activity - Plantation and adoption of a tree
4	Execution of Activity - Heritage walk and crafts corner
5	Execution of Activity - Organic farming and waste management
6	Execution of Activity - Water conservation
7	Execution of Activity - Food walk
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.
	- Each student should do activities according to the scheme and syllabus. - At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion. - At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

B.E. (Common to all Branches)			
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)			
SEMESTER – III			
Course Title:	FOREIGN LANGUAGE COURSE 1- GERMAN		
Course Code:	BFLC358A	CIE MARKS	50
(L :T : P) + SL	(1:0:0) + (15 Hours/ Sem)	SEE MARKS	50
Credits:	1	EXAM HOURS	02
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. To develop basic communication skills in German. 2. To introduce German grammar and sentence structure. 3. To enhance vocabulary in everyday and academic contexts. 4. To enable students to comprehend and respond in spoken and written German. 5. To build intercultural awareness through authentic material like short films and dialogues.			
Module 1		3 Hours	
Vocabulary for day to day activities, Time – official/inofficial, Possessive articles, Speaking about family, Time prepositions, Worksheets, Short Film			
Textbook 1: Chapter 5, 6			
Module 2		3 Hours	
Talk about hobbies, Talking about plans, Trennbare verben/seperable verbs, Going to a restaurant, Worksheets, Short Film			
Textbook: Chapter 5, 6			
Module 3		3 Hours	
Talking about jobs, Talking about the workplace, Helping verbs in Past tense , Attending events in your town, Worksheets, Short Film			
Textbook: Chapter 7, 8			
Module 4		3 Hours	
Daily routine, Body parts, Common illnesses, Visiting the doctor, Healthy living, Worksheets, Short Film			
Textbook: Chapter 7, 8			
Module 5		3 Hours	
Dativ Imperative, Small Talk...Worksheets, Short Film			
Textbook: Chapter 7, 8			

Course outcomes

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

CO1	Understand and apply basic German grammar and sentence structure.
CO2	Communicate using appropriate vocabulary and expressions in daily situations.
CO3	Fill out simple forms and conduct structured conversations
CO4	Comprehend basic written and audio-visual content in German.
CO5	Recognize basic cultural and linguistic distinctions in German-speaking countries.

Assessment Details for CIE (both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbooks

1. Netzwerk A1 Neu Kursbuch

2. Netzwerk A1 Neu Übungsbuch

Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/playlist?list=PLquImyRfMt6esqE6C4RdOeg0h0IBeYWri>
- <https://www.youtube.com/playlist?list=PLWO81tQUNYnX7laegkYvzQiMrSghMXYZCZ>
- <https://www.youtube.com/watch?v=4-eDoThe6qo>
- <https://learngerman.dw.com/en/wer-spricht/l-56577891/e-57119877>

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

- Role Play
- Flipped classroom
- Debate
- Films
- Quiz
- Games
- Handouts



B.E. (Common to all Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	FOREIGN LANGUAGE COURSE 1- SPANISH		
Course Code:	BFLC358B	CIE MARKS	50
(L :T : P) + SL	(1:0:0) + (15 Hours/ Sem)	SEE MARKS	50
Credits:	1	EXAM HOURS	02
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. To introduce learners to the basics of Spanish phonetics and vocabulary. 2. To familiarize learners with basic sentence elements such as articles, pronouns, and regular verbs. 3. To promote simple self-expression and comprehension in everyday scenarios. 4. To prepare the learners to introduce and describe a person.			
Module 1			3 Hours
Introduction and Phonetics: • Spanish alphabet and sounds. • Numbers (0–50), days and months. • Greetings and introducing yourself. Textbook: Chapter 0 and Chapter 1 – Lesson 2			
Module 2			3 Hours
Nouns and Articles • Gender and number of nouns. • Definite and indefinite articles. • Simple sentence structure with nouns. Textbook: Chapter 2 – Lesson 3			
Module 3			3 Hours
Subject Pronouns and Regular Verbs • Subject pronouns (yo, tú, él, etc.). • Present tense of regular AR/ER/IR verbs. • Making positive and negative sentences. Textbook: Chapter 2 – Lesson 4			
Module 4			3 Hours
Ser vs Estar and Adjectives • Usage of 'ser' and 'estar'. • Descriptive adjectives and agreement. • Describing people and places. Textbook: Chapter 6 – Lesson 11			

Module 5	3 Hours
Demonstratives, Possessives, and Family - Demonstrative adjectives (este, esa, etc.). - Possessive adjectives (mí, tu, su, etc.). - Talking about family and relationships. Textbook: Chapter 4 – Lesson 7 & Lesson 8; Chapter 6 – Lesson 12	

Course outcomes

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

CO1	Recognize and pronounce basic Spanish phonemes and vocabulary.
CO2	Use articles, nouns, subject pronouns and regular verbs in simple sentences
CO3	Construct and understand basic descriptive sentences using 'ser' and 'estar'
CO4	Comprehend basic written and audio-visual content in German.
CO5	Identify and describe relationships using demonstratives and possessives.

Assessment Details (both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.

- The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.

Textbook:

1. Chicos Chicas I
2. Resources and Exercises from Aventura Hispana

Weblinks:

- **YouTube channels:** Butterfly Spanish, Dreaming Spanish

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

- Role Play
- Debate
- Short videos
- Games
- Handouts



B.E. CSE (Data Science) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	AI Tools and Applications		
Course Code:	BCIL358C	CIE MARKS	50
(L: T: P) +SL	0:0:2	SEE MARKS	50
Credits:	1	EXAM HOURS	03
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Use Generative AI tools like ChatGPT, Canva, and Gamma. app for accelerating the creation of content, interactive simulations and assessments, to transform the raw material into structured, ready-to-use assets viz., content documents, presentations or visual handouts effortlessly. 2. Understand Precision Prompting: Scholarly Question Design for Reliable AI Outputs. 3. Use practical methods for leveraging Artificial Intelligence (AI) to enhance the productivity and effectiveness of academic research—specifically in ideation, literature review, and visualization of research connections. 4. Craft Adaptive Architectures for Personalised Learning Pathways using AI tools.			
Program 1			
Create high quality, structured course content Using Generative AI tools (Use ChatGPT). Example: Create a lecture on looping statements in Python, World War II, etc.			
Program 2			
Demonstrate the Canvas mode in ChatGPT Example 1: Show the Interactive Editing of Documents using prompt-based modifications. Apply a prompt like: “Make this shorter”, “Add an analogy here”, “Convert this into bullet points”. Example 2: Write a paragraph on if-else statements, select it, and prompt: “Explain this with a real-life analogy for beginners.”			
Program 3			
Demonstrate the usage of Notion (knowledge management platform) which is a smart, flexible Google Doc with extra features such as Nested pages, Toggle sections, Visual blocks (tables, images, embeds), Easy rearrangement. Example: Create or demonstrate how to: • Paste GPT-generated content into Notion • Break it into pages or collapsible sections • Prepare content for sharing or lesson delivery			
Program 4			
Demonstrate the use of Canva Docs and Canva Magic Tools.			

Example: Demonstrate how to take the AI-generated lesson (on looping Statements in Python) and copy it directly into Canva Docs, which is Canva's version of a dynamic document editor. Paste GPT/Notion Content into Canva Docs using Canva Magic Tools. Create a visually enhanced handout or lesson packet that students can download, read on mobile, or print.

After generating the topic breakdown with ChatGPT:

- Use Canva Docs to format each cause as a section
- Add relevant photos from Canva Elements
- Include a "Key Takeaway" block after each section
- Attach a short 2-question quiz at the end

Program 5

Demonstrate the use of Magic Suite-Magic Eraser/Replace, Magic transform, etc.

Example:

- Demonstrate the Magic Write feature. Say, Right-click on a paragraph, then choose actions like: "Rewrite this", "Make it more concise", "Fix grammar", "Expand this with an example", "Custom prompt" (e.g., "Explain this in simple language")
- Demonstrate the Magic Eraser / Replace feature which is Primarily used in images. Say, Erase unwanted objects (e.g., a watermark or irrelevant icon), Replace an item in an image (e.g., change a laptop to a chalkboard)
- Demonstrate the Magic Transform feature which can be used to instantly convert the above created document into multiple formats.

Program 6

Demonstrate the use of Gamma.app-AI-Powered presentation builder.

Show the following Customizations for the document created in above examples.

Feature	Example
Slide Title/Text	Edit headings or simplify slide copy
Image Replacement	Use AI to regenerate more suitable visuals
Content Rewrite	Prompt: "Make this slide simpler for high school students"
Layout Editing	Rearrange card structure or duplicate/delete cards

Program 7

Generate Questions from Content (CTRL Method). CTRL is a powerful method for precision prompting.

Example: Python Conditional Statements

- Prompt Example 1: Create 3 Multiple Choice Questions (MCQs) on Conditional Statements in Python for college students who are beginners. Keep the tone formal

and straightforward.

- Prompt Example 2: Generate 2 Match-the-columns questions on Python Conditional Statements. Keep the questions beginner-friendly and formal.
- Demo Examples:
- Using PDF as Content Source:
 - ✓ I've uploaded a PDF on "Introduction to Sociology" (provide link). Generate 5 MCQs for undergraduate students. Maintain academic tone, moderate complexity.
- Using Web Link:
 - ✓ Use the content from the following web link (provide actual URL here) and create 3 MCQs on Photosynthesis suitable for high-school biology students.

Program 8

Demonstrate the Parsons Method for Interactive Problem Statements.

Parson's Method enhances problem-solving skills by giving students code fragments or sentences they must put in the correct logical order, proven to improve conceptual understanding.

Live Demonstration Prompt:

Generate a Parson's Problem using Python conditional statements for beginner-level students. Provide shuffled code blocks for a simple "if-else" structure.

Program 9

Demonstrate the usage of AI Tools for Creating and Delivering Tests.

Tools available are: Quizizz AI, ClassMarker, Formative, Google Forms + AI (Form Presenter)

Demonstrate a Use case of AI Tools for Creating and Delivering Tests.

Once questions are created (Q7), automate their conversion into online tests for ease of deployment and analysis. Use Quizizz AI for Automated MCQs, grading and analytics.

Program 10

Demonstrate the use of AI-Driven Research Ideation (ChatGPT + Search)

Live Demonstration Example:

Example Prompt given to ChatGPT:

Suggest 3 novel research angles on the topic:

'Impact of Social Media on Mental Health' relevant to Psychology researchers.

Program 11

Deploy Elicit (elicit.com) for Rapid Literature Discovery.

To overcome manual search limitations, use Elicit, an AI-driven tool specialized in academic literature discovery.

Example: Topic provided: "What is the impact of mindfulness techniques on anxiety among university students?"

Analyzing Search Results:

Elicit automatically generates a structured table of scholarly papers directly related to your query. It quickly provides: Paper titles, Abstracts (automatically summarized), Methodologies, Participants/sample sizes, Year published, citations count, and study types. The student should Customize Table Columns: say,

Click “Columns” → Select additional details to view: Population studied, Intervention details, Outcomes measured, Research methods

Show the Advanced Filtering techniques: Say

- Filter results by: Publication date, Study type (e.g., randomized control trials, observational studies), Citations count (to identify influential papers)

Program 12

Using Consensus for Quick Expert Insights (consensus.app).

The Consensus AI tool summarizes academic research consensus clearly and visually.

Example: Enter your research query.:

"Does social media use negatively impact teenagers' mental health?"

Understand the Results: "Consensus Meter" summarizing expert agreement, Conduct In-depth Exploration of each summarized statement, do Advanced Filtering (Narrow down by year, relevance, study type, or agreement level).

Program 13

Visualizing Research Connections with Litmaps (app.litmaps.com)

Litmaps, a visualization tool that simplifies understanding complex academic citation networks visually

Example: Enter your core research paper or DOI (Digital Object Identifier).

Explore the Visual Citation Map (Connected papers represented visually, indicating citation relationships clearly. Papers connected via arrows showing who cites whom).

Interactivity and Exploration: Click on any paper node to: Quickly see its abstract, authors, citations. Explore further connections expanding research context.

Refine the Map: Filter the visualizations by: Year, Citations, Keywords, Publication type

Program 14

Explore how Generative AI can be applied in education to enable personalised learning experiences and support learners across various tasks. Use AI Tools such as Khanmigo, QuestionWell (For generating questions aligned to standards) or Diffit (For creating differentiated instructional materials).

- Example Prompt 1:

“Act as a backend software development interviewer. Ask questions about JavaScript, React, Node.js, SQL, AWS, and System Design. Provide feedback based on a rubric.”

- Example Prompt 2:

“Act as a Python Developer. Create a learning plan for someone transitioning from another programming language. Ask clarification questions before proceeding.”

- Example Prompt 3:

"Provide constructive feedback on the student's answer based on the rubric. Mention 2 strengths, 2 areas for improvement, and suggestions. Use a positive tone." Tools You Can Explore: Brisk (Chrome extension for Google Docs), MagicSchool.ai (AI assistant for teachers).

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply Generative AI tools such as ChatGPT, Canva, and Gamma.app to create structured content, simulations, and assessments.
CO2	Transform raw information into well-structured academic or professional outputs using AI tools like Canva Docs and Gamma.app.
CO3	Design precision prompts to generate reliable scholarly content and evaluation questions using advanced prompting strategies.
CO4	Utilize AI-powered platforms (e.g., Elicit, Consensus, Litmaps) to enhance productivity in research ideation, literature review, and visualization.
CO5	Create adaptive and personalized learning pathways using AI tools to support differentiated instruction and learner engagement.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Textbook

1. Sandeep Surapaneni, Introduction to AI for Non-Tech People

<https://www.scribd.com/document/855410054/AI-for-Beginners-by-Sandeep-Surapaneni>

Reference Links:

- OpenAI Prompt Engineering Guide: <https://platform.openai.com/docs/guides/prompt-engineering>
- Effective Few-shot prompting examples :
https://learnprompting.org/docs/basics/few_shot_prompting
- Parsons Problems Explained (Research-backed) :
<https://computingd.wordpress.com/2017/06/05/parsons-problems-have-same-learning-gains-as-writing-or-fixing-code-with-less-frustration-and-more-fun/>
- Example Parsons Problem Online Tool : <https://parsons.problemsolving.io/>
- Edutopia on AI Writing Feedback : <https://www.edutopia.org/article/ai-writing-feedback-students/#:~:text=As%20a%20writing%20teacher%20I,I%20like%20them%20a%20lot>

Tool	Link
ChatGPT (Canvas)	https://chat.openai.com
Notion	https://notion.so
Canva Docs	https://www.canva.com
Gamma.app	https://gamma.app
Genially	https://www.genial.ly
Quizizz AI	https://quizizz.com
H5P	https://h5p.org
AI Tutor	https://chatgpt.com/share/68358dc1-0748-8006-a2bf-c50023cc280f
Khanmigo	https://www.youtube.com/watch?v=rnlgnS8Susg&t=119s
Elicit	https://elicit.com/
Consensus	https://consensus.app/
Litmaps	https://app.litmaps.com/

B.E. CSE (Data Science) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	Data Visualization		
Course Code:	BCDL358D	CIE MARKS	50
(L: T: P) +SL	0:0:2	SEE MARKS	50
Credits:	1	EXAM HOURS	03
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Understand the Importance of Data Visualization for business intelligence and decision making. 2. Learn different approaches to understand the importance of visual perception. 3. Learn different data visualization techniques and tools. 4. Gain knowledge of effective data visuals to solve workplace problems.			
Experiment 1. Introducing Power BI, Querying Data from CSV and Text file.			
Introducing Power BI –Components and the flow of work. Power BI Desktop Interface - five main areas of the Report. Querying Data from CSV - Query Editor, Connecting the data from the Excel Source and Text file, Cleaning, and Transforming the data. Remove a column Rename a column Split columns Merge two columns Change Data type			
Experiment 2. Creating Reports, Visualizations, Filters, and Dashboards in Power BI			
Creating Reports & Visualizations - Different types of charts, Formatting charts with Titles, and Colors. Dashboards - Filters in Power BI, Formatting dashboards.			
Experiment 3. Build a Power BI report in Power BI Desktop			
Power BI report on Global Superstore Dataset: i) Import data from an Excel spreadsheet. ii) Establish relationships between tables. iii) Format the colors used in a bar chart. iv) Apply a Play button to a clustered column chart. v) Apply a title to a visual. vi) Prepare a report for mobile view.			

vii) Publish a report to Power BI service.

Experiment 4. DAX in Power BI Student Marks Analysis Dataset

Simple DAX Program on Student Marks Analysis Dataset:

- i) Import the Dataset into Power BI
- ii) Create Calculated Columns using DAX for Pass/Fail Status
- iii) Create Measures using DAX to count Total Students, Average Score, Pass Count, and Pass Percentage.
- iv) Create Card Visuals: Show Total Students, Average Score, Pass Percentage
- v) Plot Bar Chart: Name vs Scores
- vi) Pie Chart: Distribution of Pass/Fail (Result)
- vii) Column Chart: Hours studied vs Scores

Experiment 5. Tableau Workspace, Tableau terminologies, basic functionalities

Getting Started - Tableau Workspace, Tableau terminologies, basic functionalities.

Connecting to Data Source – Importing dataset in Tableau, Different types of Tableau Joins.

Experiment 6. Creating a View & Dashboard Design and Storytelling

Creating a View - formatting charts, adding filters, creating calculated fields, and defining parameters.

Dashboard Design and Storytelling Analysis of revenue in sales dataset– Components of Dashboard, understanding how to place worksheets in Containers, Action filters, and their types.

Experiment 7. Analysis of revenue in sales dataset using Tableau

Analysis of revenue in sales dataset:

- i) Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue.
- ii) Create a line chart to show the revenue based on the month of the year.
- iii) Create a bin of size 10 for the age measure to create a new dimension to show the revenue.
- iv) Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field.
- v) Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category.
- vi) Create a calculated field to show the average revenue per state & display profitable & non-profitable state.
- vii) Build a dashboard.

Experiment 8. Analysis of GDP dataset using Tableau

Analysis of GDP dataset:

- i) Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps.
- ii) Create a bar graph to compare GDP of Belgium between 2006 – 2026.
- iii) Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010.
- iv) Visualize the countries Bhutan & Costa Rica competing in terms of GDP.
- v) Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006.
- vi) Build an interactive dashboard.

Experiment 9. Analysis of HR Dataset using Power BI

Analysis of HR Dataset:

- i) Create KPI to show employee count, attrition count, attrition rate, active employees, and average age.
- ii) Create a Lollipop Chart to show the attrition rate based on gender category.
- iii) Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, drag attrition count to angle. Label attrition count, percent change, add total also, edit label.
- iv) Create a bar chart to display the number of employees by Age group,
- v) Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count.
- vi) Create a horizontal bar chart to show the attrition count for each Education field. Education field-wise attrition – drag the education field to rows, sum the attrition count to the column.
- vii) Create multiple donut charts to show the Attrition Rate by Gender for different Age groups.

Experiment 10. Analysis of Amazon Prime Dataset using Tableau

Analysis of Amazon Prime Dataset:

- i) Create a Donut chart to show the percentage of movies and TV shows
- ii) Create an area chart to show by release year and type
- iii) Create a horizontal bar chart to show the Top 10 genres
- iv) Create a map to display total shows by country
- v) Create a text sheet to show the description of any movie/movies.
- vi) Build an interactive Dashboard.

Experiment 11. Analysis of Student Performance Dataset using Power BI

Analysis of Student Performance Dataset

- i) Create KPIs to show average math score, reading score, writing score, and count of total students.
- ii) Create a stacked column chart to display average scores by gender across all subjects.
- iii) Create a clustered bar chart to show the number of students by parental level of education.

- iv) Create a pie chart to show the distribution of test preparation course completion.
- v) Create a heat map or matrix showing the average score in each subject categorized by gender and lunch type.
- vi) Create a horizontal bar chart to show average reading scores based on race/ethnicity.
- vii) Create a scatter plot to explore the correlation between math and writing scores, color-coded by gender.

Program 12. Analysis of Netflix Movies and TV Shows using Tableau

Analysis of Netflix Movies and TV Shows

- i) Create a pie chart or donut chart to show the share of Movies vs TV Shows.
- ii) Create a timeline (line/area chart) showing the number of releases per year.
- iii) Create a bar chart to show the Top 10 directors by the number of shows directed.
- iv) Create a map to visualize the distribution of content by country.
- v) Build an interactive dashboard combining filters by genre, country, type, and release year.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Conceptualize the fundamentals of Tableau and Power BI, including interfaces, terminologies, and basic functionalities.
CO2	Demonstrate proficiency in data integration using Tableau and Power BI by connecting and importing data from various sources.
CO3	Design the experiment to create basic charts and graphs using Tableau and Power BI.
CO4	Develop the solution for the given real-world problem.
CO5	Analyze and infer the results.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks.

			Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Reference Books:

1. Microsoft Power BI Dashboards Step by Step, Errin O'Connor, Pearson Education, Inc., 2019.
2. Practical Tableau 100 TIPS, TUTORIALS, AND STRATEGIES FROM A TABLEAU ZEN MASTER, Ryan Sleeper, O'Reilly, 2018, First Edition
3. Data Visualization workshop, Mario Dobler and Tim Grobmann, Packt Publishing, 2nd edition, 2020.

Web links and Video Lectures (e-Resources):

1. <https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorialhome.htm>
2. <https://www.tutorialspoint.com/tableau/index.htm>
3. <https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau>

Self-Study Topics:

Activity: Case Study based on real-world scenarios.

B.E. CSE (Data Science) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	Project Management with GIT		
Course Code:	BCSL358E	CIE MARKS	50
(L: T: P) + SL	0:0:2	SEE MARKS	50
Credits:	1	EXAM HOURS	2
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Become familiar with the basic commands of Git. 2. Learn how to create and manage branches effectively. 3. Understand the concepts of collaboration using remote repositories. 4. Become proficient with version control commands.			
Experiment 1. Setting Up and Basic Commands			
Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message			
Experiment 2. Creating and Managing Branches			
Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."			
Experiment 3. Creating and Managing Branches			
Write the commands to stash your changes, switch branches, and then apply the stashed changes.			
Experiment 4. Collaboration and Remote Repositories			
Clone a remote Git repository to your local machine.			
Experiment 5. Collaboration and Remote Repositories			
Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.			
Experiment 6. Collaboration and Remote Repositories			
Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.			
Experiment 7. Git Tags and Releases			
Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.			
Experiment 8. Advanced Git Operations			
Write the command to cherry-pick a range of commits from "source-branch" to the current branch			

Experiment 9. Analysing and Changing Git History

Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?

Experiment 10. Analysing and Changing Git History

Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."

Experiment 11. Analysing and Changing Git History

Write the command to display the last five commits in the repository's history.

Program 12. Analysing and Changing Git History

Write the command to undo the changes introduced by the commit with the ID "abc123"

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

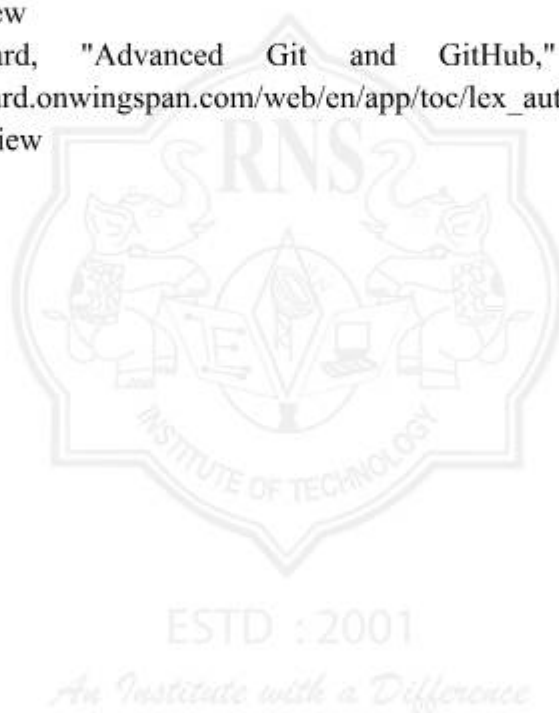
CO1	Use the basics commands related to git repository
CO2	Create and manage the branches
CO3	Apply commands related to Collaboration and Remote Repositories
CO4	Use the commands related to Git Tags, Releases and advanced git operations
CO5	Analyse and change the git history

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

References

1. P. K. Ponuthorai and J. Loeliger, "*Version Control with Git*", 3rd Edition. Sebastopol, CA, USA: O'Reilly Media, Inc., Oct. 2022.
2. S. Chacon and B. Straub, "*Pro Git*", 2nd Edition. Apress. [Online]. Available: <https://git-scm.com/book/en/v2>
3. Infosys Springboard, "Git and GitHub - Basics," [Online]. Available: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_shared/overview
4. Infosys Springboard, "Advanced Git and GitHub," [Online]. Available: https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_shared/overview



B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	NSS-National Service Scheme		
Course Code:	BNSK359	CIE MARKS	100
L : T : P: SL	0:0:0:30	SEE MARKS	0
Credits:	0	EXAM HOURS	-
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Identify the needs and problems of the community and involve the problem-solving. 2. Develop among them a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems. 3. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.			
Module-1			
Introduction and Basic Concepts of NSS Aims and Objective of NSS. Emblem, Moto, Flag Role and Responsibility of youth in various activities of NSS			
Module-2			
Youth Leadership Definition of Leadership and Important components (Social, Mental, Moral and Cultural) Qualities and Characteristics of good leaders Role of Youth leadership			
Module-3			
Community Work through NSS Community Work: Meaning and Nature Concept of regular activities undertaking of NSS			
Module-4			
NSS Activity-1			
Module-5			
NSS Activity-2			

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the motto and concepts of NSS
CO2	Develop overall personality of volunteers and make them as leaders and responsible citizens of our nation
CO3	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO4	Communicate effectively with the community and with the officials.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
Evaluation based on Reports (A)	100	-	5 modules Reports, 5 modules X 10 M each = 50 M
Total CIE Theory (A)	100	40	
SEE (B)	-	-	-
CIE+SEE (A+B)	100	40	Final marks shall be the sum of marks scored in Components A, B
- The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE. - No SEE for this subject			

Reference 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.

Weblinks

1. <https://nss.gov.in/>
2. <https://pledge.mygov.in/>

B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	Physical Education		
Course Code:	BPEK359	CIE MARKS	100
L: T: P: S	0:0:1:0	SEE MARKS	---
Credits:	---	EXAM HOURS	---
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness 2. Familiarization of health-related Exercises, Sports for overall growth and development 3. Participate in the competition at regional/state / national / international levels. 4. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.			
Module-1			5 Hours
Orientation A. Meaning and Importance of Physical Education B. Lifestyle C. Health & Wellness			
Module-2			5 Hours
General Fitness & Components of Fitness A. Meaning and Importance of Fitness B. Warming up (Free Hand exercises) C. Strength – Push-up / Pull-ups			
Module-3			5 Hours
Specific games (Anyone to be selected by the student) A. Kabaddi a) Fundamental skills Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. b) Offensive Skills: Raiding, Hand Touch, Toe Touch, Dubki, Squat Thrust c) Defensive Skills: Tackling, Ankle Hold, Thigh Hold, Waist Hold, Blocking, Chain Tackle d) Other Important Skills: Agility, Speed, Breath Control, Breath Holding e) Rules and their interpretation and duties of the officials B. Kho-Kho a) Fundamental skills			

Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

b) Skills in Chasing:

Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Rectification of foul.

c) Skills in running:

Chain Play, Ring play and Chain & Ring mixed play.

d) Game practice with application of Rules and Regulations.

e) Rules and their interpretations and duties of the officials.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
CO2	Familiarization of health-related Exercises, Sports for overall growth and development
CO3	Participate in the competition at regional/state / national / international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz (B)	40	----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks

- The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.

Textbooks

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.

Reference Books

1. Saraswati Health and Physical Education Textbook
2. V.K. Sharma's Health and Physical Education



RNS INSTITUTE OF TECHNOLOGY

An Autonomous Institute under VTU
Accredited with NAAC A+ Grade

Department of CSE (Data Science)

Autonomous Scheme (Effective from Academic Year 2024 – 25)



ESTD : 2001

An Institute with a Difference

B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	Yoga		
Course Code:	BYOK359	CIE MARKS	100
L: T: P: S	0:0:1:0	SEE MARKS	---
Credits:	---	EXAM HOURS	---
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Physical, Mental & spiritual Objectives of Yoga 2. Explain the meaning of Yoga. 3. Discuss the importance of the Yoga and its scope. 4. Describe the aims and objectives of Yoga. 5. Clarify the misconceptions on Yoga			
Module-1			5 Hours
Orientation a) Introduction of Yoga b) Aim, and Objectives of Yoga, c) Yoga, its origin, history and development.			
Module-2			5 Hours
Yoga a) Yoga, its meaning, definitions. b) Brief introduction of yogic practices for the common man c) Rules and regulations d) Misconceptions of Yoga e) Suryanamaskara			
Module-3			5 Hours
Asanas Types of Asanas: a) Sitting- 1. Padmasana, 2. Vajrasana b) Standing- 1. Vrikshana, 2. Trikonasana c) Prone line- 1. Bhujangasana 2. Shalabh asana d) Supine line- 1. Utthita dvipadasana 2. Ardha halasana			

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Yoga
CO2	improves of health and related aspects, overall growth and development
CO3	Participate in the competition at regional/state / national / international levels.

CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
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ASSESSMENT DETAILS (Both CIE and SEE)

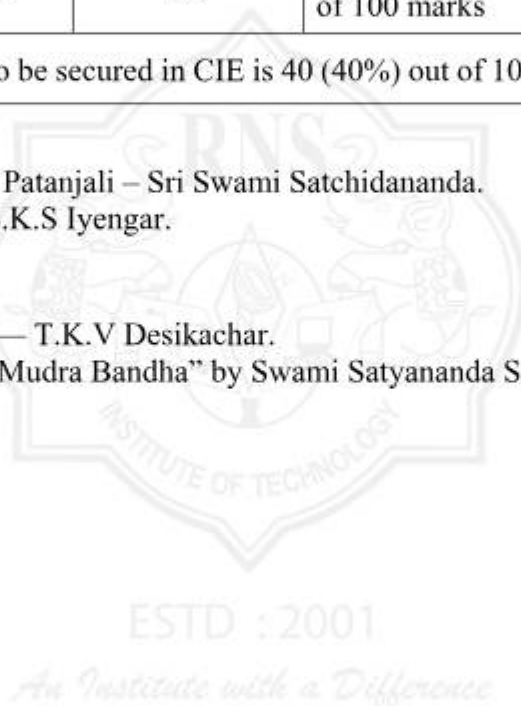
Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz (B)	40	----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks
The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.			

Textbooks

1. The Yoga Sutras of Patanjali – Sri Swami Satchidananda.
2. Light on Yoga — B.K.S Iyengar.

Reference Books

1. The Heart of Yoga — T.K.V Desikachar.
2. “Asana Pranayama Mudra Bandha” by Swami Satyananda Saraswati.



IV SEMESTER SUBJECTS

ESTD : 2001

An Institute with a Difference

B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Design and Analysis of Algorithms		
Course Code:	BCS401	CIE MARKS	50
(L: T: P) + SL	(3:2:0) + (45 Hours/Sem)	SEE MARKS	50
Credits:	4	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Learn the methods for analyzing algorithms and evaluating their performance.			
2. Demonstrate the efficiency of algorithms using asymptotic notations.			
3. 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.			
4. Learn the concepts of P and NP complexity classes.			
Module-1			9 Hours
Fundamentals: What is an Algorithm? Fundamentals of Algorithmic Problem Solving, Important Problem types, fundamentals of the analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive Algorithms, Mathematical Analysis of Recursive Algorithms.			
Problem Complexity: Limitations of Algorithm Power, Non- Deterministic Algorithms, P, NP, NP Complete, and NP-Hard classes.			
Textbook 1: Chapter-1(1.1-1.3), Chapter-2(2.1-2.4), Chapter-11(11.1-11.3)			
Module-2			9 Hours
Brute-Force and Exhaustive search: Selection Sort, Bubble Sort, Sequential Search and String Matching, Assignment Problem, Knapsack Problem, Travelling Salesman Problem			
Decrease-and-Conquer: Insertion sort, Topological Sorting			
Divide-and-Conquer: Merge Sort, Quicksort, Max Min Algorithm, Strassen's Matrix Multiplication.			
Textbook 1: Chapter-3 (3.1-3.2,3.4) Chapter-4 (4.1-4.2) Chapter-5 (5.1-5.2,5.4)			
Textbook 2: Chapter-3 (3.3)			
Module-3			9 Hours
Greedy Technique: Prim's Algorithm, Kruskals Algorithm, Dijkstra's Algorithm, Huffman Trees, Greedy Knapsack			
Transform and Conquer: Balanced Search Trees (AVL trees), Heapsort.			
Textbook 1: Chapter-9 (9.1-9.4) Chapter-6 (6.3-6.4) Text book 2: Chapter-4 (4.2)			

Module-4	9 Hours
Dynamic Programming: Multistage Graph, The Knapsack Problem and Memory functions, Warshall's Algorithm, Floyd's Algorithms. Space and Time Trade-offs: Sorting by Counting (Comparison & Distributed), Input Enhancement in String Matching: Horspool's algorithm.	
Textbook 1: Chapter-8 (8.2,8.4) Chapter-7 (7.1-7.2)	
Module-5	9 Hours
Backtracking: n-Queens Problem, Hamiltonian Circuit problem, Subset-Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesman Problem. Decision Trees: Decision Trees for Sorting.	
Textbook 1: Chapter-12 (12.1-12.2) Chapter-11 (11.2)	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply fundamental concepts of algorithmic problem solving, analyse algorithm efficiency using asymptotic notations, and differentiate problem complexity classes like P, NP, NP-Hard Complete, and NP-Hard.
CO2	Analyse brute-force, decrease-and-conquer, and divide-and-conquer algorithms to solve basic sorting, searching, and matrix problems.
CO3	Apply greedy techniques and transform-and-conquer strategies to solve real-world problems such as minimum spanning trees, shortest paths, and efficient sorting.
CO4	Solve optimization problems using dynamic programming and understand space-time trade-offs in algorithm design with string matching and counting techniques.
CO5	Apply backtracking and branch-and-bound strategies to constraint satisfaction and combinatorial problems and understand the use of decision trees in analysing algorithm complexity.

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive	10	-	Any one Assessment methods as per 24RNB4.2 scaled to 10 marks.

Evaluation (B)			
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson 2014.
2. Ellis Horowitz, Satraj Sahni, Rajasekharam, "Fundamentals of Computer Algorithms", 2nd University Press Pvt. Ltd 2009.

Reference Books

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein "Introduction to Algorithms", 3rd MIT Press 2009.
2. Padma Reddy, "Analysis and Design of Algorithms", 1st Sri Nandi Publications 2009.

B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Database Management Systems		
Course Code:	BCS402	CIE MARKS	50
(L : T : P) + SL	(3:0:2) + (45 Hours/Sem)	SEE MARKS	50
Credits:	4	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Understand the fundamental concepts, architecture, and advantages of Database Management Systems and their role in data handling. 2. Design and model database schemas using Entity-Relationship (ER) diagrams and map conceptual designs to relational models. 3. Write efficient SQL queries for data definition, manipulation, and retrieval, and understand NoSQL databases and their applications. 4. Apply normalization techniques to design well-structured relational database schemas and eliminate redundancy. 5. Comprehend transaction processing, concurrency control, and recovery techniques to ensure data integrity and reliability in database systems.			
Module – 1			9 Hours
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER Diagrams, Naming Conventions, and Design Issues.			
Textbook 1: Ch 1.1 to 1.7, 2.1 to 2.2, 2.5 to 2.6, 3.1 to 3.7			
Module – 2			9 Hours
Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.).			
Textbook 1: Ch 9.1; Ch 5.1 to 5.3, Ch 8.1 to 8.4			
Module – 3			9 Hours

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. More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL.

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document-Based NOSQL Systems and MongoDB.

Textbook 1: Ch 6.1 to 6.5, Ch 7.1 to 7.3, Ch 24.1 to 24.3

Module – 4

9 Hours

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.

Relational Database Design Algorithms: Functional Dependencies: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, About Nulls, Dangling Tuples.

Textbook 1: Ch 14.1 to 14.5, Ch 15.1 – 15.4

Module – 5

9 Hours

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.

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering.

Database Recovery Techniques: Recovery Concepts, NO-UNDO/REDO Recovery Based on Deferred Update, Recovery Techniques Based on Immediate Update.

Textbook 1: Ch 20.1 to 20.6, Ch 21.1 to 21.2, Ch 22.1 – 22.5, 22.7

PRACTICAL COMPONENT OF IPCC

SL No.	EXPERIMENTS
PART A	
1	Introduction of concept of rows and columns with attribute names using MS-Excel File or Spreadsheet with multiple sheets representing multiple tables.

2	Introduction of simple databases like SQL Lite / Oracle 11g / MySQL or online SQL interfaces such as https://livesql.oracle.com/ with CREATE, ALTER, DROP, INSERT, DELETE, UPDATE, GRANT, REVOKE,... SQL statements
3	Introduction to ER – Diagram and Schema writing with all the concepts like types of attributes, entity types, participation ratio, cardinality ratio, structural constraints, etc., Case studies on databases such as Banking, Airline, Employee, Library to be discussed in detail.
4	Installation of an Open-Source NoSQL Database MongoDB & perform basic CRUD (Create, Read, Update & Delete) operations. Execute MongoDB basic Queries using CRUD operations. https://www.mongodb.com/try/download/community
5	Consider the following schema for a Library Database: BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name) PUBLISHER (Name, Address, Phone) BOOK_COPIES (Book_id, Branch_id, No-of_Copies) BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH (Branch_id, Branch_Name, Address) BORROWER (Card_no, Name, Address, Phone) Write SQL queries to a. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. b. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. c. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. d. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. e. Create a view of all books and its number of copies that are currently available in the Library.
6	Consider the following schema for Order Database: SALESMAN (Salesman_id, Name, City, Commission) CUSTOMER (Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to a. Count the customers with grades above Bangalore's average. b. Find the name and numbers of all salesmen who had more than one customer. c. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) d. Create a view that finds the salesman who has the customer with the highest order of a day. e. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

7	Consider the schema for Movie Database: ACTOR (Act_id, Act_Name, Act_Gender) DIRECTOR (Dir_id, Dir_Name, Dir_Phone) MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST (Act_id, Mov_id, Role) RATING (Mov_id, Rev_Stars) Write SQL queries to - List the titles of all movies directed by 'Hitchcock'. - Find the movie names where one or more actors acted in two or more movies. - List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). - Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. - Update rating of all movies directed by 'Steven Spielberg' to 5
8	Consider the schema for College Database: STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) SUBJECT (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to - List all the student details studying in fourth semester 'C' section. - Compute the total number of male and female students in each semester and in each section. - Create a view of Test1 marks of student USN '1RN25CS100' in all subjects. - Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students. - Categorize students based on the following criterion: If FinalIA = 17 to 20 then CAT = 'Outstanding' If FinalIA = 12 to 16 then CAT = 'Average' If FinalIA < 12 then CAT = 'Weak'. Give these details only for 8th semester A, B, and C section students.

9	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 - 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. - Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. - 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. - Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). - 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.
PART B	
10	Mini Project - Batch formation with a 2 – 3 students in a batch and topic finalization. The following are to be included in the mini – project: - Design of database using ER Diagram / Schema Diagram - Implementation of backend using both Structured and Unstructured databases. - Front-end design using any scripting languages like JavaScript, PHP, Python etc. - Must include an innovative component in the implementation of the project. - Projects must be uploaded into GitHub repository for final submission with public access and all the documentation for demonstration. - A mini project report with soft binding with formats as specified by the department to be submitted at the end after demonstration.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Define the fundamentals of DBMS architecture, data models, and ER modelling concepts.
CO2	Construct ER diagrams into relational schemas and apply relational algebra operations.
CO3	Formulate SQL queries and differentiate between SQL and NoSQL databases.
CO4	Apply normalization techniques to design relational schemas up to BCNF.
CO5	Analyse transaction processing and implement concurrency control and recovery techniques.

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks

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

Reference Books

1. Database Management Systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
2. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, McGraw Hill, 2013.

Weblinks:

1. <https://www.youtube.com/@databasemanagementsystem-i4463> (NPTEL)
2. <https://www.youtube.com/playlist?list=PLxCzCOWd7aiFAN6I8CuViBuCdJgiOkT2Y>
3. https://www.youtube.com/watch?v=c5HAWKX-suM&ab_channel=SCALER
4. <https://www.geeksforgeeks.org/dbms/dbms/>

Self – Study topics:

Module 3: (Ch 24.4 – 24.6)

NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j

Module 4: (Ch 14.6 – 14.7)

Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Module 5: (21.3 – 21.5)

Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

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

1. <https://www.hackerrank.com/domains/sql> - to explore the problem solving
2. Case Study based flip class

B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Microcontrollers and IoT		
Course Code:	BCS403	CIE MARKS	50
(L: T: P) + SL	(3:0:2) + (45 Hours / Sem)	SEE MARKS	50
Credits:	4	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Understand the basics of ARM architecture, registers, exceptions, and interrupts.			
2. Use ARM instructions for data processing, memory access, and software interrupts.			
3. Write efficient C programs and understand how interrupts are handled.			
4. Learn about sensors, actuators, and IoT communication protocols.			
5. Build simple IoT applications using Arduino Uno and communication modules.			
Module-1		9 Hours	
ARM Processor Fundamentals- Registers, Current Program Status Register, Exceptions, Interrupts, Vector Table.			
Introduction to the ARM Instruction Set- Data Processing Instructions, Branch Instructions.			
Text book 1: Chapter-2(2.1-2.2,2.4),Chapter-3(3.1-3.2)			
Module-2		9 Hours	
Load-Store Instructions, Software Interrupt Instruction. Program Status Register Instructions.			
Text book 1: Chapter-3(3.3-3.5(Excluding 3.5.1,3.5.2))			
Module-3		9 Hours	
Efficient C Programming			
Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures. Exception and Interrupt Handling, Exception Handling, Interrupts.			
Textbook 1: Chapter 5(5.1-5.3),Chapter-9(9.1-9.2)			
Module-4		9 Hours	
What is IoT? Transducers, Sensors and Actuators- Defining Transducers, Sensors and Actuators, Introduction to transducers, Introduction to Sensors.			
IoT Protocols- Protocol Classification, MQTT, COAP, REST.			
Textbook2: Chapter-1(1.1), Chapter-2 (2.1-2.2,2.3.1,2.3.2.1-2.3.2.2,2.4), Chapter-3 (3.1-3.2,3.6-3.7)			
Module-5		9 Hours	
Introduction to Arduino, Exploring Arduino Uno Learning Board, Installing the software Fundamentals of Arduino Programming, Introduction to Communications, Example Module on Arduino.			
Textbook 2: Chapter-7(7.1-7.6)			

PRACTICAL COMPONENT OF IPCC

SL No.	EXPERIMENTS
PART A	
1	Write an ALP to find the sum of the first 10 integer numbers.
2	Write an ALP to i) Multiply two 16-bit numbers. ii) Add two 32-bit numbers.
3	Write an ALP to find the factorial of a number.
4	Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
5	Write an ALP to find the square of a number (1 to 10) using a look-up table.
6	Write an ALP to find the largest or smallest number in an array of 32 numbers.
7	Write an ALP to arrange a series of 32-bit numbers in ascending/descending order.
8	Write an ALP to count the number of ones and zeros in two consecutive memory locations.
9	Assembly Language Program (ALP).
PART B	
10	<u>Using any IoT Interfacing Boards</u> - Develop a program to blink 5 LEDs back and forth. - Develop a program to control a DC motor. - Develop a program to deploy smart streetlight system using LDR sensor. - Develop a program to classify dry and wet waste with the Moisture sensor (DHT22). - Develop a program to detect the gas leakage in the surrounding environment. - Develop a water level depth detection system using Ultrasonic sensor.
Demo Experiments	
11	- Develop a program to setup a UART protocol and pass a string through the protocol. - Develop a program to demonstrate weather station readings.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Interpret the ARM architecture, registers, exceptions, interrupts, and the vector table.
CO2	Apply ARM instructions for data processing, branching, and software interrupts.
CO3	Demonstrate efficient embedded C programming techniques and optimization strategies.

CO4	Illustrate the role of sensors and actuators in IoT systems, and evaluate various IoT communication protocols
CO5	Develop simple IoT-based embedded applications using MCUs and sensor modules.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	30	12	Marks of Tests and Assignments awarded for a maximum of 30.
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	20	8	Marks of Experiments, Record and Test awarded for a maximum of 20 marks.
CIE: Theory + Practical (A + B + C)	50	20	CIE Evaluation is done for a maximum of 50 marks.
SEE (D)	50	18	SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE+SEE (A+B+C+D)	100	40	Final marks shall be the sum of marks scored in Components A, B, C and D
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Textbooks:

1. N. Sloss, D. Symes, and C. Wright, “ARM System Developer’s Guide”, Amsterdam, Netherlands: Elsevier/Morgan Kaufmann, 2008.
2. K. G. Srinivasa, G. M. Siddesh, and R. Hanumantha Raju, “Internet of Things”, New Delhi, India: Cengage India, 2018.

Reference Books:

1. Raghunandan, “Microcontroller (ARM) and Embedded System”, New Delhi, India: Cengage Learning, 2019.
2. A. Bahga and V. Madiseti, “Internet of Things: A Hands-On Approach”, 1e. Universities Press, 2014.

Weblinks:

1. https://onlinecourses.nptel.ac.in/noc20_cs15/preview
2. <https://www.arm.com>
3. https://en.wikipedia.org/wiki/ARM_architecture_family
4. <https://developer.arm.com/documentation>
5. https://developer.arm.com/documentation/dui0041/c/ARM-Compiler-Reference/C-and-C---implementation-details/Basic-data-types?utm_source=chatgpt.com
6. https://www.emqx.com/en/blog/iot-protocols-mqtt-coap-lwm2m?utm_source=chatgpt.com
7. https://www.fortinet.com/resources/cyberglossary/iot?utm_source=chatgpt.com
8. https://www.emqx.com/en/blog/iot-protocols-mqtt-coap-lwm2m?utm_source=chatgpt.com
9. <https://www.arduino.cc>

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

- Flipped Classroom
- Role Play
- Group Discussion (GD)
- Model Building / Concept Mapping
- Peer Teaching / Student Seminars
- Project Based Learning



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Accredited with NAAC A+ Grade

Department of CSE (Data Science)

Autonomous Scheme (Effective from Academic Year 2024 – 25)



ESTD : 2001

An Institute with a Difference

B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Design and Analysis of Algorithms Laboratory		
Course Code:	BCSL404	CIE MARKS	50
L: T: P	0:0:2	SEE MARKS	50
Credits:	1	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Learn the methods for analysing algorithms and evaluating their performance to demonstrate the efficiency of algorithms using asymptotic notations. 2. Demonstrate the efficiency of algorithms using asymptotic notations. 3. 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. 4. Learn the concepts of P and NP complexity classes.			
Program 1. Selection Sort – Sorting Student IDs			
Design and implement a C program to sort a list of student roll numbers from a university database using the Selection Sort algorithm.			
Objective: Record and compare the time taken for sorting as the number of student records increases ($n > 5000$).			
Application: Helps in managing ordered student data efficiently for attendance systems or result generation.			
Program 2. Merge Sort – Organizing Medical Reports			
Design and implement a C program to sort large sets of patient report IDs using Merge Sort.			
Objective: Track execution time for datasets with $n > 5000$ and plot time vs data size.			
Application: Efficient sorting of medical records in a hospital management system.			
Program 3. Quick Sort – E-Commerce Order Sorting			
Design and implement a C program to sort customer order IDs based on timestamps using Quick Sort.			
Objective: Measure performance on data size > 5000 and plot performance graph.			
Application: Fast processing of online orders in an e-commerce platform.			
Program 4. Topological Sort – Task Scheduling in Project Management			
Implement a C program to find the topological ordering of tasks in a project where some tasks depend on the completion of others.			
Application: Automating task scheduling tools like Jira or Trello where dependencies exist.			
Program 5. 0/1 Knapsack – Cargo Optimization			
Implement a C program to solve the 0/1 Knapsack problem to maximize the value of items packed in a delivery truck with weight constraints.			

Application: Logistic companies optimizing truck loads with limited capacity
Program 6. Greedy Knapsack – Stock Refill Strategy
Implement a C/C++ program to solve discrete and fractional knapsack problems using greedy methods to choose items for shelf restocking in a supermarket based on value-to-weight ratio. Application: Inventory management and optimization.
Program 7. Dijkstra's Algorithm – GPS Navigation System
Implement a C/C++ program to find shortest paths from a given location to all other locations in a city's road network. Application: GPS systems like Google Maps, for calculating the shortest routes.
Program 8a. Floyd's Algorithm – Travel Time Optimization Problem:
Implement a C/C++ program to find the shortest paths between all pairs of cities in a country using Floyd's algorithm. Application: Railway or airline scheduling and route planning.
Program 8b. Warshall's Algorithm – Webpage Reachability
Implement a C/C++ program to determine reachability between all webpages using Warshall's algorithm on a hyperlink graph. Application: Search engines identifying which pages link to others.
Program 9. Kruskal's Algorithm – Designing Network Layouts
Implement a C/C++ program to find the Minimum Cost Spanning Tree of a network using Kruskal's algorithm. Application: Laying cables (like fiber optic) for minimum cost in a connected campus or city.
Program 10. Prim's Algorithm – Power Grid Optimization
Implement a C/C++ program to build the minimum cost electricity network using Prim's algorithm. Application: Designing cost-effective electricity distribution networks.
Program 11. Subset Sum – Payment Combinations
Implement a C/C++ program to find all payment combinations using a set of coin or currency denominations that sum up to a required amount. Application: ATM cash dispensing or vending machines.
Program 12. N-Queens – Security Camera Placement
Implement a C/C++ program to solve the N-Queens problem to place security cameras in a museum grid such that no two cameras cover the same row, column, or diagonal. Application: Surveillance system optimization.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Analyse and implement sorting algorithms such as Selection Sort, Merge Sort, and Quick Sort to solve domain-specific problems.
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CO2	Apply graph-based algorithms such as Topological Sort, Dijkstra's, Floyd's, Warshall's, Kruskal's, and Prim's algorithms to solve real-time optimization and scheduling problems
CO3	Design and develop efficient solutions using Dynamic Programming techniques for combinatorial problems.
CO4	Solve resource allocation problems using Greedy algorithms and demonstrate their effectiveness in constrained environments.
CO5	Implement backtracking techniques to solve constraint satisfaction problems such as the N-Queens problem.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Weblinks:

1. Virtual Labs (CSE): <http://cse01-iiith.vlabs.ac.in/>

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning Mini Project:

1. Simulation of Algorithms
2. Leet Coding



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ESTD : 2001

An Institute with a Difference

B.E. (CSE and Allied Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	Linear Algebra		
Course Code:	BCS405A	CIE MARKS	50
(L: T : P) : SL	(3:0:0) + (45 Hours / Sem)	SEE MARKS	50
Credits:	3	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
1. To help students to understand System of linear equations and vector spaces. 2. To impart basics of Eigen Values and Eigen Vectors and their importance. 3. To facilitate students in applying inner product in Gram- Smidth process. 4. To provide some special operations of vector spaces and Matrices.			
Module-1		9 Hours	
The geometry of linear equations, existence and uniqueness, LU-decomposition and computational complexity, Vector Spaces and subspaces (Definitions only), The column space and null space of a given matrix, linearly independent, Bases and dimension, Null space and column space of a matrix, The four fundamental subspaces.			
Textbook 2: Ch - 1.2, 1.5, 2.1, 2.3, 2.4			
Module-2		9 Hours	
Eigen values and Eigen vectors, Diagonalization, Eigen vectors and linear transformations, Complex Matrices.			
Textbook 2: Ch - 5.1,5.2, 5.5			
Module-3		9 Hours	
Inner product, length and orthogonality, orthogonal sets and projections, orthonormal Basis, Gram-Schmidt process, QR-factorization, least square approximation, Rotation.			
Textbook 1: Ch- 6.1, to 6.4, 6.7			
Module-4		9 Hours	
Diagonalization of symmetric matrices, quadratic forms and its classifications, constrained optimisation and Singular value decomposition, Application to Image Processing.			
Textbook 1: Ch - 7.1 to 7.5			
Module-5		9 Hours	
The intersection, sum, Cartesian product and the Tensor product of two vector spaces, The Kronecker Product of Two Matrices, Jordan canonical form.			
Textbook 2: Ch A – A.1 to A.5 and B			

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Explain the fundamental concepts of vector spaces and subspaces.
CO2	Apply the concept of linear independence, basis and dimension in solving problems.
CO3	Perform computations using linear transformations and their matrix representations.
CO4	Analyze eigenvalues and eigenvectors and their applications.
CO5	Evaluate inner product spaces and orthogonality principles.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. - If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.			

Textbooks:

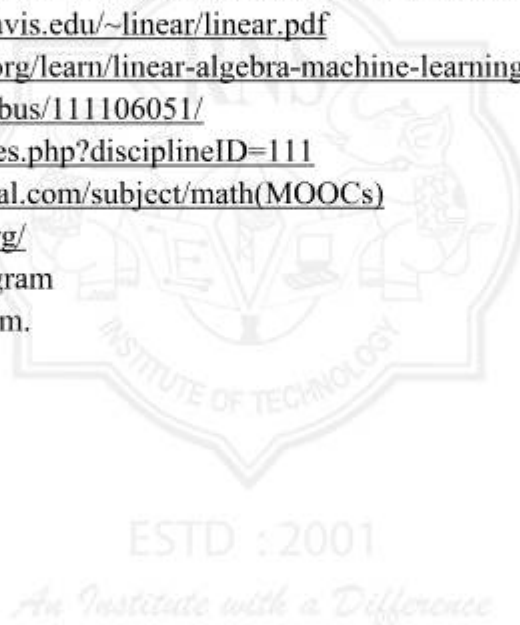
1. David C. Lay, Steven R. Lay, Judi J Mc. Donald: “Linear Algebra and its applications”, Pearson Education, 4th Edition, 2017.
2. Gilbert Strang: “Linear Algebra and its applications”, Brooks Cole, 4th edition, 2005.

Reference Books:

1. Richard Bronson & Gabriel B. Costa: “Linear Algebra: An Introduction”, 2nd edition. Academic Press, 2014.
2. Seymour Lipschutz, Marc Lipso: “Theory and problems of linear algebra”, Schaum’s outline series - 6th edition, 2017, McGraw-Hill Education.
3. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong: “Mathematics for Machine learning”, Cambridge University Press, 2020.

Web links and Video Lectures (e-Resources):

1. <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
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\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
7. <http://academicearth.org/>
8. VTU e-Shikshana Program
9. VTU EDUSAT Program.



B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Graph Theory		
Course Code:	BCS405B	CIE MARKS	50
(L :T : P): SL	(3:0:0) + (45 Hours / Sem)	SEE MARKS	50
Credits:	03	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Understand the basic concepts of graphs and their properties, and operations of graphs. 2. Hamiltonian and Euler graphs, trees and matrix representation of the graph. 3. Apply the concepts of a planar graph, matching and colouring in computer science engineering.			
Module-1		9 Hours	
Introduction. Basic definition, Application of graphs, finite, infinite and bipartite graphs, Incidence and Degree, Isolated vertex, pendant vertex and Null graph. Paths and circuits, Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.			
Text 1: Ch- 1.1 to 1.5, Ch - 2.1, 2.2, 2.4, 2.5			
Module-2		9 Hours	
Eulerian and Hamiltonian graphs, Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem, directed graphs, types of digraphs, Digraphs and binary relation.			
Text 1: Ch- 2.6 - 2.10			
Module-3		9 Hours	
Trees -properties, pendant vertex, Distance and centers in a tree, Rooted and binary trees, counting trees, spanning trees.			
Connectivity Graphs -Vertex Connectivity, Edge Connectivity, Cut set and Cut Vertices, Fundamental circuits and cut-sets.			
Text 1: Ch - 3.1 to 3.7, 4.1, 4.3 and 4.5.			
Module-4		9 Hours	
Planar Graphs -Planar graphs, Kuratowski's theorem (proof not required), Different representations of planar graphs, Euler's theorem, Geometric dual.			
Graph Representations: Matrix representation of graphs, Adjacency matrix, Incidence Matrix, Circuit Matrix, Path Matrix.			
Text 1: Ch - 5.2 to 5.6, 7.1 to 7.3, 7.8 and 7.9.			
Module-5		9 Hours	

Graph Colouring-Colouring, Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem and Five colour problem, Greedy colouring algorithm.

Text 1: Ch - 8.1, 8.3 to 8.6.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Explain basic definitions and types of graphs used in modeling.
CO2	Apply solutions using directed graphs and network flows.
CO3	Analyze shortest path algorithms and spanning tree techniques.
CO4	Evaluate Graphical representation of different types of Matrices and the representation of Planar Graphs.
CO5	Design graph colouring, matching, and planar graphs in applications.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

ASSESSMENT DETAILS (Both CIE and SEE)			
Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE	100	40	Final marks shall be the sum of marks

(A+B+C)			scored in Components A, B and C.
- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.			

Textbooks

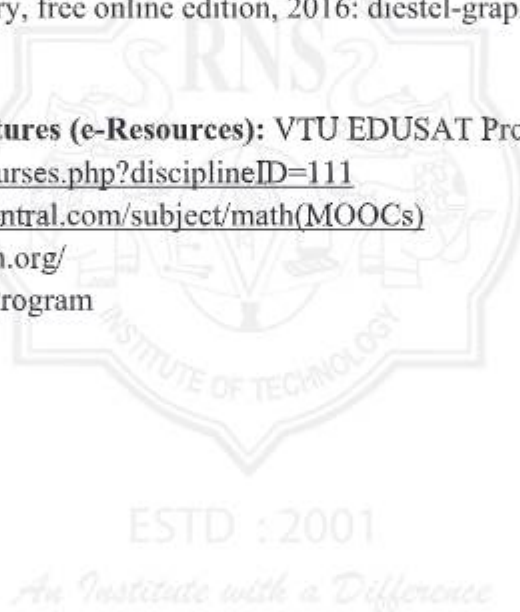
- Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016
- J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 2008.

Reference Books

- Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
- Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.
- R. Diestel, Graph Theory, free online edition, 2016: diestel-graph-theory.com/basic.html.

Web links and Video Lectures (e-Resources): VTU EDUSAT Program

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU e-Shikshana Program



B.E. (CSE and Allied Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – IV			
Course Title:	Metric Spaces		
Course Code:	BCS405C	CIE MARKS	50
(L :T : P): SL	(3:0:0) + (45 Hours / Sem)	SEE MARKS	50
Credits:	03	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
1. Provide insight into the theory of sets 2. Learn basic concepts of metric spaces 3. Understand the concepts of connected sets and compact spaces			
Module-1			9 Hours
Finite and infinite sets, countable and uncountable sets, cardinality of sets, Schroder-Bernstein theorem, cantor's theorem, Order relation in cardinal numbers, Arithmetic of cardinal numbers, Partially ordered set, Zorn's lemma and axioms of choice, various set-theoretic paradoxes.			
Textbook 1 0.1–0.4 (Appendix/Preliminaries) Reference 3: 1.1, 1.6–1.8, 1.9			
Module-2			9 Hours
Definition and examples of metric spaces, Open spheres and Closed spheres, Neighborhoods, Open sets, Interior, Exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set.			
Textbook 1: 1.1, 2.1–2.3, 3.1–3.4 Textbook 2: 1.1, 2.1–2.5, 3.1–3.3			
Module-3			9 Hours
Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, nowhere dense sets and Baire's category theorem, continuous and uniformly continuous functions, Homeomorphism. Banach contraction principle.			
Textbook 1: 4.1–4.3, 5.1–5.4, 6.1, 7.1–7.3 Textbook 2: 4.1–4.4, 5.1–6.3, 9.1–9.2			
Module-4			9 Hours
Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, Totally bounded set, equivalence of compactness and sequential compactness.			
Textbook 1: 8.1–8.5 Textbook 2: 7.1–7.4			
Module-5			9 Hours

Separated sets, Disconnected and connected sets, components, connected subsets of $\mathbb{R}$, Continuous functions on connected sets. Local connectedness and arc-wise connectedness.

Textbook 1: 9.1–9.3

Textbook 2: 8.1–8.4

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Explain the basic concepts of metric spaces and normed spaces.
CO2	Apply the concept of open, closed, and compact sets in metric spaces.
CO3	Analyze convergence, continuity, and completeness
CO4	Evaluate the role of completeness and contraction mappings.
CO5	Apply Baire's Theorem and Heine-Borel Theorem in analysis.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C .

- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.
- **If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.**

Textbooks

1. P.K. Jain & Khalil Ahamad, "*Metric Spaces*". Narosa, 2019.
2. Micheal O; Searcoid, "*Metric spaces*". Springer-Verlag, 2009.

Reference Books

1. Satish Shirali & Harikishan L. Vasudeva, "*Metric Spaces*", Springer-Verlag, 2006.
2. E.T. Copson, "*Metric spaces*", Cambridge University Press, 1988.
3. P.R. Halmos, "*Naive Set Theory*". Springer, 1974.
4. S. Kumaresan, "*Topology of Metric spaces*", 2nd edition, Narosa, 2011.



B.E. (CSE and Allied Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Game Theory		
Course Code:	BCS405D	CIE MARKS	50
(L :T : P): SL	(3:0:0) + (45 Hours / Sem)	SEE MARKS	50
Credits:	03	EXAM HOURS	03
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Comprehend the basics of strategic gaming and mixed strategic equilibrium. 2. Enable students to develop skills on extensive gaming strategies. 3. Analyze and discuss various gaming models. 4. Illustrate some real-time situations.			
Module-1			9 Hours
Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions. Textbook 1: Ch – 1.1 to 1.2, 2.1 to 2.4, 2.6 to 2.9			
Module-2			9 Hours
Introduction: Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population. Textbook 1: Ch – 4.1 to 4.7			
Module-3			9 Hours
Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Sub- game perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games; Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly. Textbook 1: Ch – 5.2 to 5.6, 6.2 to 6.3			
Module-4			9 Hours
Bayesian Games, Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations. Textbook 1: Ch – 9.1 to 9.7, 9.9			
Module-5			9 Hours
Competitive Games: Strictly competitive games and maximization. Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.			

Textbook 1: Ch – 11.3, 14.1 to 14.6

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Describe basic game theory concepts including utility, payoff, and strategy.
CO2	Apply two-player zero-sum game models using different strategies.
CO3	Analyze Nash equilibrium and mixed strategy solutions.
CO4	Evaluate dominant strategies and minimax approaches in games
CO5	Construct models for real-world strategic situations using game theory.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to			

appear for SEE.

- If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.

Textbooks

1. **Martin J. Osborne:** “*An Introduction to Game Theory*”, Oxford University Press, 1st Ed., 2003.
2. **Martin J. Osborne and Ariel Rubinstein:** “*A Course in Game Theory*”, MIT Press, 1st Ed., 1994

Reference Books

1. **John von Neumann and Oskar Morgenstern:** “*Theory of Games and Economic Behavior*”, Princeton University Press, 60th Anniversary Ed., 2007.
2. **R. Duncan Luce and Howard Raiffa:** “*Games and Decisions: Introduction and Critical Survey*”, Dover Publications, Reprint Ed., 1989.
3. **Roger B. Myerson:** “*Game Theory: Analysis of Conflict*”, Harvard University Press, 1st Ed., 1997.
4. **Robert Gibbons:** “*Game Theory for Applied Economists*”, Princeton University Press, 1st Ed., 1992.

Web links and Video Lectures (e-Resources):

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. VTU e- Shikshana Program
5. VTU EDUSAT Program.
6. <http://www.themathpage.com/>
7. <http://www.abstractmath.org/>
8. <http://www.ocw.mit.edu/courses/mathematics/>

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

- Quizzes
- Assignments
- Seminar

B.E. (Common to All branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Finance and Accounting		
Course Code:	BFAT456A	CIE MARKS	50
(L: T: P) + S	(1:0:0) + (15 HOURS / SEM)	SEE MARKS	50
Credits:	01	EXAM HOURS	02
COURSE LEARNING OBJECTIVES:			
1. To enable the students to understand the conceptual framework of accounting, reporting and financial statements.			
2. To enable the students in understanding of books of accounts and accounting records leading to final accounts and interpretation there-off.			
3. To acquaint the students with the concepts of Time value of Money for decision making.			
Module-1		3 Hours	
Introduction to Accounting: Meaning and objectives, Branches of Accounting, GAAP, IAS, IFRS, Concepts and Conventions, Users of accounting, accounting terminologies. (Only Theory)			
Self-Learning Activity: Self-exploration exercise where students write about their understanding of Golden rules of Accounting, Classification of Assets and Liabilities. Students can Compare GAAP, IAS, and IFRS side by side on Origin, purpose, scope, key differences.			
Textbook 1: Section 1; Chapter 1, 2 and 3			
Module-2		3 Hours	
Journal, Ledgers, Trial balance, accounting equation, subsidiary books and final accounts (Only theory)			
Self-Learning Activity: Students will write the liquidity and Profitability status by reading the financial statements of a Company.			
Textbook 1: Section 1; Chapter 4, 5, 6 and 8			
Module-3		2 Hours	
Emerging accounting Practices: Window dressing, forensic accounting, Green Accounting, Human resource accounting and sustainability reporting.			
Self-Learning Activity: Students will understand the significance of human resources accounting in the corporate environment.			
Textbook 2: Chapter 6			

Module-4		3 Hours
Overview of Financial Management: Meaning and scope- objectives of Financial Management-Functions of Finance-Role and functions of finance managers. Indian Financial System: Structure-types-Financial markets- Financial Instruments - Financial institutions and financial services- Non-Banking Financial Companies (NBFCs). (Theory only) Self-Learning Activity: Students will have to understand the classification of Banking industry and write the functions of Banking and Non -banking Organisations. Textbook 3: Part 1; Chapter 1 and 2		
Module-5		4 Hours
Emerging areas in Financial Management: Risk Management- Behavioural Finance- Financial Engineering- Derivatives (Theory). Time Value of Money: Time value of money –Future value of single cash flow & annuity –Present value and discounting-present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest & loan amortization schedule (Simple problems on FV, FV for Annuity, PV and PV for annuity & Amortization Schedule) Self-Learning Activity: Students will Write their own simple problems based on the concepts and solve them. Example: “Calculate the FV of \$1,000 invested for 5 years at 6% compound interest.” Students are engaged in preparing the Loan amortisation table with detailed interpretation. Students can Create mind maps showing the relationships and key components of risk management, financial engineering, derivatives, and behavioural finance. Textbook 3: Part III; Chapter 6		

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Recall the basic accounting concepts and terminologies
CO2	Understanding of journal, ledger, trial balance subsidiary books and accounting Equation and final accounts.
CO3	Analyse emerging trends in accounting
CO4	Familiar with the Emerging areas of financial management and create a Loan Amortisation table.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbooks

1. Accounting for Management, Maheswari S. N, Maheswari Sharad K, Vikas Publishing House (P) Ltd., Ed 2024.
2. Accounting for Managers, H.H. Ramesha, Pralhad Rathod, Praveen Kumar B. H., R.G. Saha, Himalaya Publishing House Pvt Ltd.,
3. Financial Management, Prasanna Chandra, TMH, Ed 2024

References

1. Financial Management, Ravi M Kishor, Taxmann's. (Recent Edition)
2. Financial Management, I M Paney, Vikas Publishing House Pvt. Ltd. (Recent Edition)
3. Accounting for Management, Dr Jawahar Lal, Himalaya Publishing House Pvt Ltd., (Recent Edition)

B.E. CSE (Data Science)			
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)			
SEMESTER – IV			
Course Title:	MONGODB		
Course Code:	BCDL456B	CIE MARKS	50
(L :T : P) + SL	(0:0:2)	SEE MARKS	50
Credits:	1	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
CO1: Understand basic MongoDB functions, operators and types of operations in MongoDB			
CO2: Demonstrate the use of Indexing, Advanced Indexing in MongoDB.			
CO3: Apply the aggregation and Map Reduction in MongoDB.			
CO4: Demonstrate text searching on collections in MongoDB.			
Experiments			
1. a. Illustration of Where Clause, AND, OR operations in MongoDB.			
b. Execute the Commands of MongoDB and operations in MongoDB: Insert, Query, Update, Delete and Projection. (Note: use any collection)			
2. a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection.			
b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find]			
3. a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection			
b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection			
4. Create and demonstrate how projection operators (\$, \$elematch and \$slice) would be used in the MondoDB.			
5. Execute Aggregation operations (\$avg, \$min,\$max, \$push, \$addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators)			
6. Execute Aggregation Pipeline and its operations (pipeline must contain \$match, \$group, \$sort, \$project, \$skip etc. students encourage to execute several queries to demonstrate various aggregation operators)			
7. a. Find all listings with listing_url, name, address, host_picture_url in the listings and Reviews collection that have a host with a picture url			
b. Using E-commerce collection write a query to display reviews summary.			
8. a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes)			

b. Demonstrate optimization of queries using indexes
9. a. Develop a query to demonstrate Text search using catalog data collection for a given word. b. Develop queries to illustrate excluding documents with certain words and phrases
10. Develop an aggregation pipeline to illustrate Text search on Catalog data collection.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Make use of MongoDB commands and queries.
CO2	Illustrate the role of aggregate pipelines to extract data.
CO3	Demonstrate optimization of queries by creating indexes.
CO4	Develop aggregate pipelines for text search in collections.

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Textbooks

1. MongoDB: The Definitive Guide”, Kristina chodorow, 2nd ed O'REILLY, 2013.

Web links and Video Lectures (e-Resources):

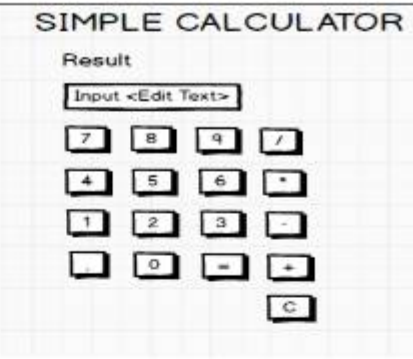
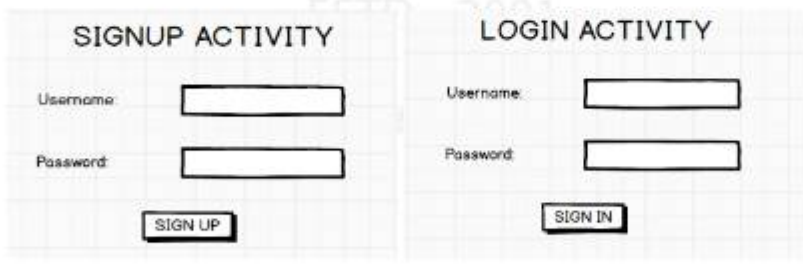
- Installation of MongoDB Video: <https://www.youtube.com/watch?v=dEm2AS5amyA>
- Video on Aggregation: <https://www.youtube.com/watch?v=vx1C8EyTa7Y>

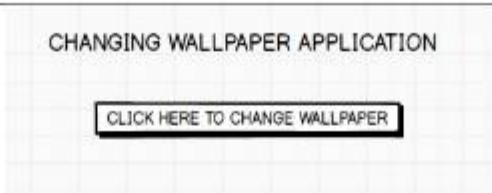
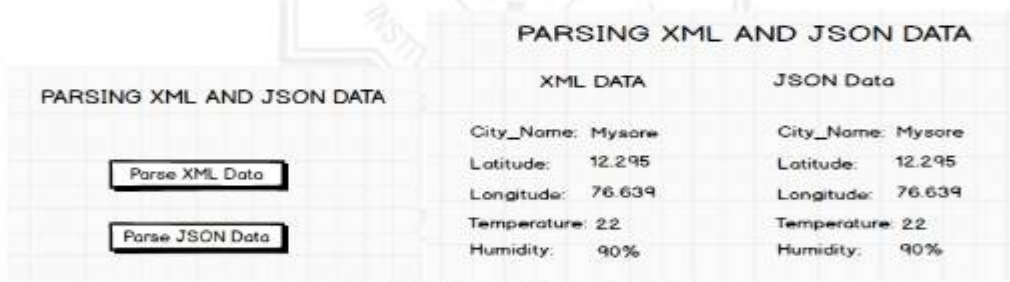
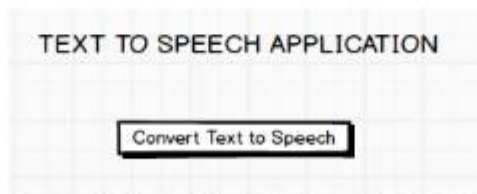
- MongoDB in action book Code download URL:
<https://www.manning.com/downloads/529>
- MongoDB Exercise URL: <https://www.w3resource.com/mongodb-exercises/>



B.E. CSE (Data Science)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	MOBILE APPLICATION DEVELOPMENT		
Course Code:	BCSL456C	CIE MARKS	50
(L: T: P) +SL	0:0:2	SEE MARKS	50
Credits:	01	EXAM HOURS	3
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Develop basic Android applications by applying fundamental programming concepts and techniques. 2. Configure and use Android Studio IDE for designing, coding, and testing mobile applications. 3. Design and implement user interfaces using Android UI components such as layouts, widgets, and event handlers. 4. Create and manage local databases using SQLite for data storage and retrieval within Android apps. 5. Demonstrate data sharing techniques by implementing services, content providers, and inter-process communication in Android.			
Description:			
1. The installation procedure of the Android Studio/Java software must be demonstrated and carried out in groups. 2. Students should use the latest version of Android Studio/Java/ Kotlin to execute these programs. Diagrams given are for representational purposes only, students are expected to improvise on them. 3. Part B programs should be developed as an application and are to be demonstrated as a mini project in a group by adding extra features or the students can also develop their application and demonstrate it as a mini-project. (Projects/programs are not limited to the list given in Part B).			

SL No.	EXPERIMENTS
PART A	
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 , 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. COMPANY NAME  Name Job Title Phone Number Address Email, website, fax details

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.	
3	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.	
4	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.	

	CHANGING WALLPAPER APPLICATION 														
5	Write a program to create an activity with two buttons START and STOP. On pressing 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. 														
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.  <table border="1"> <thead> <tr> <th colspan="2">PARSING XML AND JSON DATA</th> </tr> <tr> <th>XML DATA</th> <th>JSON Data</th> </tr> </thead> <tbody> <tr> <td>City_Name: Mysore</td> <td>City_Name: Mysore</td> </tr> <tr> <td>Latitude: 12.295</td> <td>Latitude: 12.295</td> </tr> <tr> <td>Longitude: 76.639</td> <td>Longitude: 76.639</td> </tr> <tr> <td>Temperature: 22</td> <td>Temperature: 22</td> </tr> <tr> <td>Humidity: 90%</td> <td>Humidity: 90%</td> </tr> </tbody> </table>	PARSING XML AND JSON DATA		XML DATA	JSON Data	City_Name: Mysore	City_Name: Mysore	Latitude: 12.295	Latitude: 12.295	Longitude: 76.639	Longitude: 76.639	Temperature: 22	Temperature: 22	Humidity: 90%	Humidity: 90%
PARSING XML AND JSON DATA															
XML DATA	JSON Data														
City_Name: Mysore	City_Name: Mysore														
Latitude: 12.295	Latitude: 12.295														
Longitude: 76.639	Longitude: 76.639														
Temperature: 22	Temperature: 22														
Humidity: 90%	Humidity: 90%														
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.														

pressing the SAVE button it must save the number to the phone contacts.

CALL AND SAVE APPLICATION

1	2	3
4	5	6
7	8	9
*	0	#

PART B

- 1 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.

MEDICINE DATABASE

Medicine Name:

Date:

Time of the Day:

- 2 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".

MEETING SCHEDULE

Date:

Time:

Meeting Agenda:

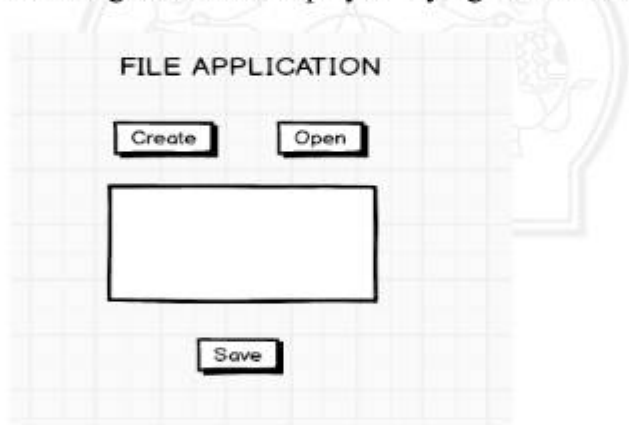
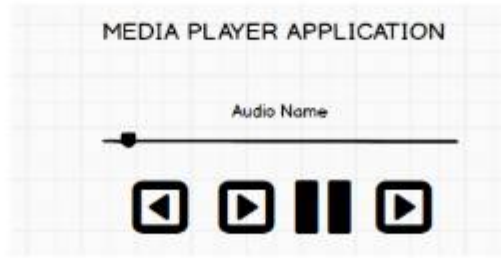
MEETING INFO

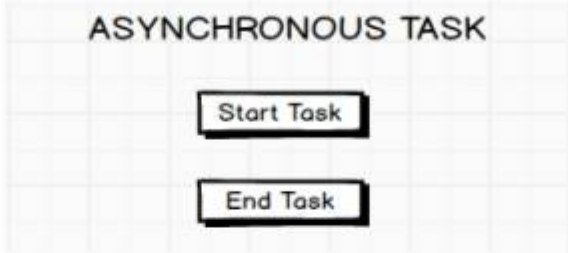
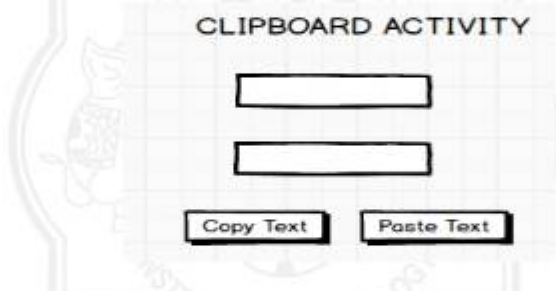
Pick a date to get meeting info 

No. of days

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

CANCEL OK

3	Create an application to receive an incoming SMS which is notified to the user. On clicking this SMS notification, the message content and the number should be displayed on the screen. Use appropriate emulator control to send the SMS message to your application.  The screenshot shows a mobile application interface titled "SMS APPLICATION". It contains two text labels: "Display SMS Number" and "Display SMS Message".
4	Write a program to create an activity having a Text box, and also Save, Open and Create buttons. The user has to write some text in the Text box. On pressing the Create button the text should be saved as a text file in Mksdcard. On subsequent changes to the text, the Save button should be pressed to store the latest content to the same file. On pressing the Open button, it should display the contents from the previously stored files in the Text box. If the user tries to save the contents in the Textbox to a file without creating it, then a toast message has to be displayed saying "First Create a File".  The screenshot shows a mobile application interface titled "FILE APPLICATION". It features three buttons: "Create", "Open", and "Save". Below the buttons is a large empty text box for input.
5	Create an application to demonstrate a basic media player that allows the user to Forward, Backward, Play and Pause an audio. Also, make use of the indicator in the seek bar to move the audio forward or backward as required.  The screenshot shows a mobile application interface titled "MEDIA PLAYER APPLICATION". It includes a seek bar with a slider and the label "Audio Name". Below the seek bar are four control buttons: a previous button (left arrow), a play button (right arrow), a pause button (two vertical bars), and a next button (right arrow).

6	Develop an application to demonstrate the use of Asynchronous tasks in android. The asynchronous task should implement the functionality of a simple moving banner. On pressing the Start Task button, the banner message should scroll from right to left. On pressing the Stop Task button, the banner message should stop. Let the banner message be “Demonstration of Asynchronous Task”. 
7	Develop an application that makes use of the clipboard framework for copying and pasting of the text. The activity consists of two EditText controls and two Buttons to trigger the copy and paste functionality. 
8	Create an AIDL service that calculates Car Loan EMI. The formula to calculate EMI is $E = P * (r(1+r)^n)/((1+r)^n - 1)$ where E = The EMI payable on the car loan amount P = The Car loan Principal Amount r = The interest rate value computed on a monthly basis n = The loan tenure in the form of months The down payment amount has to be deducted from the principal amount paid towards buying the Car. Develop an application that makes use of this AIDL service to calculate the EMI. This application should have four EditText to read the Principal Amount, Down Payment, Interest Rate, Loan Term (in months) and a button named as “Calculate Monthly EMI”. On click of this button, the result should be shown in a TextView. Also, calculate the EMI by varying the Loan Term and Interest Rate values.

CAR EMI CALCULATOR

Principal Amount:

Down Payment:

Interest Rate:

Loan Term (in months):

EMI: Result

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Describe the architecture and components of Android operating system.
CO2	Build simple mobile applications using Android Studio.
CO3	Integrate UI elements and layouts for user-friendly design.
CO4	Develop mobile apps using activities, intents, and fragments.
CO5	Debug and test Android applications on emulators and real devices.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30		Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20		Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.

SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Textbooks

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.
<https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details>
(Download pdf file from the above link)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
2. Pierre-Olivier Laurence, Amanda Hinchman-Dominguez, Mike Dunn, "Programming Android with Kotlin", 1st Edition, O'Reilly SPD Publishers, 2021.
3. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 3rd Edition, Big Nerd Ranch Guides, 2017. ISBN-13: 978-0134706054

ESTD : 2001

An Institute with a Difference

B.E. CSE (Data Science) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – IV			
Course Title:	JULIA		
Course Code:	BCIL456D	CIE MARKS	50
L : T : P:	0:0:2	SEE MARKS	50
Credits:	01	EXAM HOURS	03
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. To introduce the basics of Julia programming language. 2. To illustrate the data structures of Julia programming language. 3. To make use of built-in functions and packages.			
Program 1			
a. Develop a Julia program to simulate a calculator (for integer and real numbers). b. Develop a Julia program to add, subtract, multiply and divide complex numbers. c. Develop a Julia program to evaluate expressions having mixed data types (integer, real, floating-point number and complex).			
Program 2			
a. Develop a Julia program for the following problem: A computer repair shop charges \$100 per hour for labour plus the cost of any parts used in the repair. However, the minimum charge for any job is \$150. Prompt for the number of hours worked and the cost of parts (which could be \$0) and print the charge for the job. b. Develop a Julia program to calculate a person's regular pay, overtime pay and gross pay based on the following: If hours worked is less than or equal to 40, regular pay is calculated by multiplying hours worked by rate of pay, and overtime pay is 0. If hours worked is greater than 40, regular pay is calculated by multiplying 40 by the rate of pay, and overtime pay is calculated by multiplying the hours in excess of 40 by the rate of pay by 1.5. Gross pay is calculated by adding regular pay and overtime pay.			
Program 3			
a. An amount of money P (for principal) is put into an account which earns interest at r% per annum. So, at the end of one year, the amount becomes $P + P \times r/100$. This becomes the principal for the next year. b. Develop a Julia program which reads numbers from a file (input.txt) and finds the largest number, smallest number, count, sum and average of numbers.			
Program 4			
a. Develop a Julia program and two separate functions to calculate GCD and LCM. b. Develop a Julia program and a recursive function to calculate factorial of a number. c. Develop a Julia program and a recursive function to generate Fibonacci series.			
Program 5			
a. Develop a Julia program which reads a string (word) and prints whether the word is palindrome.			

b. Develop a Julia program which reads and prints the words present in a file (input.txt) having Random Data in which words are dispersed randomly (Assumption: a word is a contiguous sequence of letters. A word is delimited by any non-letter character or end-of-line).

Program 6

a. Develop a Julia program to determine and print the frequency with which each letter of the alphabet is used in a given line of text.

b. Develop a Julia program to generate a plot of mathematical equation: $y = \sin(x) + \sin(2x)$.

Program 7

a. A survey of 10 pop artists is made. Each person votes for an artist by specifying the number of the artist (a value from 1 to 10). Develop a Julia program to read the names of the artists, followed by the votes, and find out which artist is the most popular.

b. Develop a Julia program to generate a plot of (solid & dotted) a function: $y=x^2$ (use suitable data points for x).

Program 8

a. Given a line of text as input, develop a Julia program to determine the frequency with which each letter of the alphabet is used (make use of dictionary)

b. Develop a Julia program to fetch words from a file with arbitrary punctuation and keep track of all the different words found (make use of set and ignore the case of the letters: e.g. to and To are treated as the same word)

Program 9

a. Develop a Julia program to evaluate expressions consisting of rational, irrational number and floating point numbers)

b. Develop a Julia program to determine the following properties of a matrix: determinant, inverse, rank, upper & lower triangular matrix, diagonal elements, Euclidean norm and Square Root of a Matrix.

Program 10

a. Develop a Julia program to determine addition and subtraction of two matrices (element - wise).

b. Develop a Julia program to perform multiplication operation on matrices: scalar multiplication, element wise multiplication, dot product, cross product.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the syntax, environment setup, and fundamental constructs of the Julia language.
CO2	Apply Julia's control structures and functions to develop basic programs.
CO3	Use and manipulate data structures such as arrays, tuples, sets, and dictionaries in Julia.

CO4	Utilize built-in functions and external packages for mathematical and scientific computation.
CO5	Demonstrate the ability to debug, test, and optimize Julia code for problem-solving tasks.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	12	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	8	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	50	20	Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.
SEE (C)	50	20	SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum mark to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Textbooks

- "Think Julia: How to Think Like a Computer Scientist", Authors: Ben Lauwens, Allen B. Downey, Publisher: O'Reilly Media, ISBN: 9781492045034.
- Julia Programming Projects, Author: Adrian Salceanu, Publisher: PackPublishing, Description: Intermediate-level book focusing on solving real-world problems using Julia.
- Mastering Julia, Author: Malcolm Sherrington, Publisher: Packt Publishing.

Reference Links:

- The Julia Programming Language- <https://julialang.org>
- Julia Documentation - <https://docs.julialang.org>



RNS INSTITUTE OF TECHNOLOGY

An Autonomous Institute under VTU
Accredited with NAAC A+ Grade

Department of CSE (Data Science)

Autonomous Scheme (Effective from Academic Year 2024 – 25)



ESTD : 2001

An Institute with a Difference

B.E. (Common to All Branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	ENVIRONMENTAL STUDIES		
Course Code:	BENS407 / 507	CIE MARKS	50
(L : T : P)+ SL	(2:0:0) + (30 Hours/Sem)	SEE MARKS	50
Credits:	2	EXAM HOURS	2
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Introduce the basic concepts of ecology and ecosystem functioning, including biodiversity and biogeochemical cycles.			
2. Understand various types of environmental pollution, their sources, impacts, and preventive measures.			
3. Explore causes of environmental degradation and methods of conservation with special emphasis on Indian biodiversity.			
4. Create awareness about climate change, global warming, environmental legislation, and significant environmental movements in India.			
Module-1			6 Hours
Ecology: Basic concepts of ecosystem. Ecosystems (structure and function)- forest, desert, wetlands, river, oceanic and lake. Biotic and Abiotic components; Food chain; Ecological pyramid.			
Biogeochemical Cycles: carbon cycle, nitrogen cycle, phosphorus cycle, water cycle			
Sustainability: 17 Sustainable Development Goals (SDG)- history, targets, implementation, capacity development.			
Module-2			6 Hours
Environmental Pollution: Surface and ground water pollution, noise pollution, soil pollution, air pollution and marine pollution - sources, impacts on living beings, impacts on environment, preventive measures. case-study on marine pollution.			
Water Chemistry: Significance and effect of pH, total dissolved solids and hardness. Case study on impact of fluoride on human health.			
Module-3			6 Hours
Environmental Degradation: Causes and effects of deforestation, desertification, soil erosion and glacier melting.			
Environmental Conservation: Significance and key features of national parks, wildlife sanctuaries, reserved forest and mangrove forest. Importance of western ghats as biodiversity hotspot (flora and fauna)			
Module-4			6 Hours
Indian Monsoon and Global Warming			
Climate- Impact on monsoons, significance of El Nino and La Nina on India climate.			

Global warming: causes, greenhouse gases, effects on environment and human health. Causes and effects of acid rain and ozone depletion. Air sampler and its importance in assessing pollutants.

Module-5

6 Hours

Environmental Legislation: Environmental Protection Act 1984: Definition, Significance and key features.

Indian Environmental Movements: Bishnoi Movement, Chipko & Appiko movement.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Describe the components and functions of ecosystems and explain major biogeochemical cycles and sustainability goals.
CO2	Understand various forms of pollution and environmental degradation, along with their impacts on ecosystems and human health.
CO3	Demonstrate awareness of climate issues, Indian environmental legislation, and the role of community-based movements in environmental protection.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	12	Average of Three Internal Assessment Tests each of 50 marks, scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	8	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration should be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.

The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.

Textbooks

1. Benny Joseph, "Environmental studies", 3rd ed., Tata McGraw-Hill, 2017.
2. S M Prakash, "Environmental studies", 3rd ed., Pristine publishing house, 2018.

Reference Books: -

1. M.Anji Reddy, "Textbook of environmental science and Technology", revised ed., BS publications, 2014.
2. Dr. B.S Chauhan, "Environmental studies", 1st ed., University of science press, 2008.

B.E. (Common to all branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV / V			
Course Title:	BIOLOGY FOR ENGINEERS		
Course Code:	BBOE407/507	CIE MARKS	50
(L: T: P) + SL	(2:0:0) + (30 Hours/Sem)	SEE MARKS	50
Credits:	2	EXAM HOURS	2
COURSE LEARNING OBJECTIVES:			
<i>The purpose of the course is to facilitate the learner to:</i>			
1. Familiarize the students with the basic biological concepts and their engineering applications.			
2. Enable the students with an understanding of bio design principles to create novel devices and structures.			
3. Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.			
4. Motivate the students to develop interdisciplinary vision of biological engineering.			
Module-1		6 Hours	
Introduction to fundamentals of life. Structure and functions of a cell. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, Enzymes and Lipids.			
Module-2		6 Hours	
Introduction to applications of biomolecules, Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, Enzymes in biosensors fabrication, food processing, enzymes in biobleaching, Lipids in biodiesel and detergents production.			
Module-3		6 Hours	
Introduction to adaptations of anatomical principles for bioengineering design, Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.			
Module-4		6 Hours	
Introduction to nature inspired biomaterials and mechanisms, Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Artificial blood - haemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).			

Module-5	6 Hours
Introduction to trends in bioengineering, Tissue engineering, stem cells and their applications, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Corroborate the concepts of biomimetics for specific requirements.
CO2	Understand the basic biological concepts for relevant industrial applications. adaptation.
CO3	Evaluate the principles of design and development, for exploring engineering knowledge in biological
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	12	Average of Three Internal Assessment Tests each of 50 marks, scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	8	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration should be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

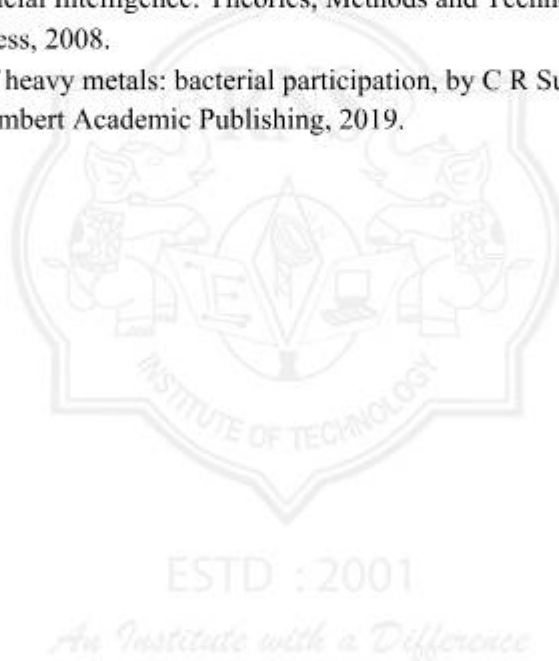
Textbooks

1. Basuchandra's Biology for Engineers, Chandra shekara. B.M, Basavaraju B.C, 2025.

2. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.

Reference Books

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W.
3. Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.



B.E. (Common to All branches)			
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)			
SEMESTER – IV			
Course Title:	Universal Human Values (UHV)		
Course Code:	BUHV408	CIE MARKS	50
(L: T: P) + S	(1:0:0) + (15 HOURS / SEM)	SEE MARKS	50
Credits:	01	EXAM HOURS	02
COURSE LEARNING OBJECTIVES:			
The purpose of the course is to facilitate the learner to:			
4. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.			
5. 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. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.			
6. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.			
7. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.			
Module-1		3 Hours	
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.			
Self-Learning Activity: Self-exploration exercise where students write about their understanding of happiness and prosperity.			
Module-2		3 Hours	
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.			
Self-Learning Activity: Students will categorize their daily needs into 'self' and 'body' to understand their coexistence.			
Module-3		3 Hours	
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.

Self-Learning Activity: Students will write and share a personal story where trust or respect played a key role in a relationship.

Module-4

3 Hours

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, The Holistic Perception of Harmony in Existence.

Self-Learning Activity: Students will have a nature walk to observe and reflect on coexistence and mutual fulfilment in nature.

Module-5

3 Hours

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.

Self-Learning Activity: Students are engaged in drafting their personal code of professional ethics aligned with human values.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Identify and describe the role of self, family, society, and nature in achieving holistic human well-being.
CO2	Analyze real-life personal and societal problems through the lens of human values and ethical reasoning.
CO3	Apply human values to interpersonal and professional situations to ensure harmony in relationships and society.
CO4	Integrate sustainability, ethics, and lifelong learning into personal and professional practices.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.

Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbooks

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 kantik, 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. Susan 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 Nagaraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantik.

17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
21. M Govindrajan, 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.



B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	NSS-National Service Scheme		
Course Code:	BNSK459	CIE MARKS	100
L : T : P	0:0:0:30	SEE MARKS	0
Credits:	0	EXAM HOURS	-
COURSE LEARNING OBJECTIVES: The purpose of the course is to facilitate the learner to: 1. Understand the community in general 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 in general.			
Module-1			
Water conservation techniques – Role of different stakeholders– Implementation.			
Module-2			
Preparing an actionable business proposal for enhancing the village income and approach for implementation.			
Module-3			
Helping local schools to achieve good results and enhance their enrolment in Higher/technical/ vocational education.			
Module-4			
NSS Activity-1			
Module-5			
NSS Activity-2			

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the significance of individual responsibilities towards society and contribute meaningfully to community welfare.
CO2	Analyze environmental and societal issues, and design feasible solutions to address them effectively
CO3	Critically evaluate existing systems and propose practical, sustainable solutions for long-term development.
CO4	Plan and implement government initiatives or self-driven projects effectively in real-life community settings.
CO5	Develop the capacity to respond to emergencies and natural disasters, while practicing national integration, social harmony, and unity in diversity.

ASSESSMENT DETAILS (Both CIE and SEE)

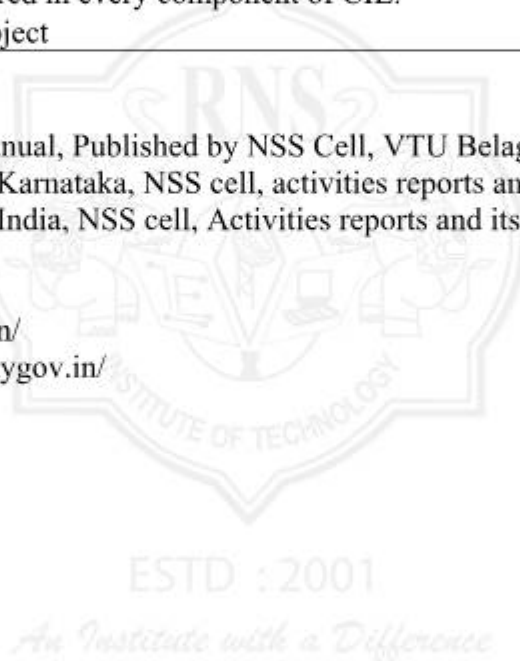
Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
Evaluation based on Reports (A)	100	-	5 modules Reports, 5 modules X 10 M each = 50 M
Total CIE Theory (A)	100	40	
SEE (B)	-	-	-
CIE+SEE (A+B)	100	40	Final marks shall be the sum of marks scored in Components A, B
- The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE. - No SEE for this subject			

Reference 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.

Weblinks:

1. <https://nss.gov.in/>
2. <https://pledge.mygov.in/>



B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	Physical Education		
Course Code:	BPEK459	CIE MARKS	100
L: T: P: S	0:0:1: 0	SEE MARKS	---
Credits:	---	EXAM HOURS	---
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness 2. Familiarization of health-related Exercises, Sports for overall growth and development 3. Participate in the competition at regional/state / national / international levels. 4. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.			
Module-1			5 Hours
Athletics A. Track - Sprints B. Throws - Shotput C. Jumps - Long jump A. Track Events i. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. ii. Acceleration with proper running techniques. iii. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug, Torso Finish. B. Long Jump Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing C. Shot put Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique)			
Module-2			5 Hours
Volleyball A. Fundamental skills 1. Service: Underarm Service, Side arm Service, Tennis Service, Floating Service 2. Pass: Under arm Pass, Overhead Pass 3. Spiking & Blocking 4. Game Practice with application of Rules & Regulations			

B. Rules and their interpretation and duties of the officials

Module-3

5 Hours

Throwball

A. Fundamental skills

Overhand service, Side arm service, two hand catching, one hand overhead return, side arm return.

B. Rules and their interpretation and duties of the officials

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
CO2	Familiarization of health-related Exercises, Sports for overall growth and development
CO3	Participate in the competition at regional/state / national / international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Zero-credit NCMC courses (MCQs for assessment)			
Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	---	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz (B)	40	---	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks
The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.			

Textbooks

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata

Reference Books: -

1. Saraswati Health and Physical Education
2. V.K. Sharma's Health and Physical Education
3. Oswaal Books: Educart Chapterwise Question Bank: Offers detailed coverage of concepts and questions by chapter.



B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	Yoga		
Course Code:	BYOK459	CIE MARKS	100
L: T: P: S	0:0:1:0	SEE MARKS	---
Credits:	---	EXAM HOURS	---
COURSE LEARNING OBJECTIVES: <i>The purpose of the course is to facilitate the learner to:</i> 1. Physical, Mental & spiritual Objectives of Yoga 2. Explain the meaning of Yoga. 3. Discuss the importance of the Yoga and its scope. 4. Describe the aims and objectives of Yoga. 5. Clarify the misconceptions on Yoga			
Module-1			5 Hours
Patanjali Ashtanga Yoga A. Yama: Ahimsa, satya, asteya, brahmacarya, aparigraha B. Niyama: shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan C. Suryanamaskara: 12 Counts, 4 Rounds			
Module-2			5 Hours
Asana a) Meaning, Need & Importance of Asana b) Different Types of Asanas: i. Sitting - 1. Sukhasana, 2. Paschimottanasana ii. Standing - 1. Ardhakati Chakrasana 2. Parshva Chakrasana iii. Prone line - Dhanurasana iv. Supine line - Halasana c) Asana Technique d) Precautionary measures and benefits of each Asana			
Module-3			5 Hours
Pranayama A. Meaning, Need & importance of Pranayama. Different types of pranayama, technique, precautionary measures and benefits of each Pranayama. 1. Suryanuloma -Viloma 2. Chandranu loma-Viloma B. Kapalabhati Meaning, importance and benefits of Kapalabhati.			

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Yoga
CO2	improves of health and related aspects, overall growth and development
CO3	Participate in the competition at regional/state / national / international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz (B)	40	----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks
The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.			

Textbooks

1. The Yoga Sutras of Patanjali – Sri Swami Satchidananda.
2. Light on Yoga — B.K.S Iyengar.

Reference Books: -

1. The Heart of Yoga — T.K.V Desikachar.
2. “Asana Pranayama Mudra Bandha” by Swami Satyananda Saraswati.



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