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BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)

Yelahanka, Bengaluru 560119

Bachelor of Engineering

Department of Computer Science and Engineering

III Semester Scheme 2022
Scheme
Effective from the AY 2025-26

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Vision and Mission of the Department

Vision

To be a centre of excellence in Computer Science and Engineering education and research, nurturing technically competent, ethically responsible, and socially conscious professionals to meet global challenges and drive sustainable innovation.

Mission

M1. To impart quality education in Computer Science and Engineering by integrating fundamental knowledge with emerging technologies and industry practices.

M2. To foster innovation, problem-solving, and research aptitude through a curriculum enriched with project-based learning, professional activities, and collaborative initiatives.

M3. To develop graduates with strong ethical values, leadership qualities, and a commitment to lifelong learning through co-curricular and extra-curricular activities.

Program Educational Objectives (PEOs)

PEOs	
PEO1	**Professional Excellence:** Pursue successful careers in industry, academia, and entrepreneurship by applying the foundational knowledge of Computer Science and Engineering with professional competence.
PEO2	**Higher Education and Lifelong Learning:** Engage in higher studies, research, or professional development programs, demonstrating a commitment to lifelong learning in a rapidly evolving technological landscape.
PEO3	**Ethics and Social Responsibility:** Exhibit ethical behavior, effective communication, teamwork, and leadership qualities, with a strong sense of responsibility toward society and the environment.

Program Specific Outcomes (PSOs)

PSOs	
PSO-1	**Apply theoretical foundations, Algorithmic principles and software engineering practices to develop efficient and scalable IT solutions.**
PSO-2	**Design effective systems by leveraging principles of computing and communication technologies**

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BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

REVISED

Date: 18-12-2024

CONTINUOUS INTERNAL EVALUATION (CIE)
AND
SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable to UG students admitted from the 2022 batch, effective from the Academic year 2024-25 onwards)

The UG students admitted from the 2022 batch onwards are hereby informed to note the following regarding Continuous Internal Evaluation and Semester End Examination pattern:

- The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examination (SEE) is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

IPCC COURSES: 4 CREDITS OR 3 CREDITS						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			

	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	05	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**25**	**10**	
Practical Component	CIE - Practical		30	15	-	Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE Practical Test		20	10	-	One test after all experiments to be conducted for **20 Marks**
	Total CIE Practical			**25**	**10**	
Total CIE Theory + Practical				**50**	**20**	
SEE			100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	
The laboratory component of the IPCC shall be for CIE only.						

Professional Core Courses (PCC) / Engineering Science Courses (ESC): 03 and 02 Credit						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

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NON-IPCC COURSES: 01 Credit Course - MCQ						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation Component	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, examination duration is 01 hour.
CIE + SEE				**100**	**40**	

Professional Core Course Laboratory (PCCL) /Ability Enhancement Course Laboratory (AEC) - 01 Credit					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
Semester End Examination		100	50	18	SEE to be conducted for **100 Marks**.
CIE+SEE		**100**		**40**	

Learning Activities for CCAs:

A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 18/12/2024

Dean AA 18.12.24

Principal 18/12/24

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2022, 2023, and 2024 batch.
3. Examination Section

Scheme of III Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)
Scheme of Teaching and Examination: Effective from AY 2025 – 26
Choice Based Credit System (CBCS)
Computer Science and Engineering

UG PROGRAM: B.E. Computer Science and Engineering (CSE) **Semester : III**

Sl. No	Course Category	Course Code	Course Code	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week Credits					Examination				
					L	T	P	S	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	Credits
1	PCC/BSC	BCS301	Mathematics for Computer Science	TD: Maths PSB: Maths	3	1	0		4	50	50	100	03	4
2	IPCC	BCS302	Digital Design & Computer Organization	TD: CS PSB: CS	3	0	1		4	50	50	100	03	4
3	IPCC	BCS303	Operating Systems	TD: CS PSB: CS	3	0	1		4	50	50	100	03	4
4	PCC	BCS304	Data Structures and Application	TD: CS PSB: CS	3	0	0		3	50	50	100	03	3
5	PCCL	BCSL305	Data Structures Laboratory	TD: CS PSB: CS	0	0	1		1	50	50	100	03	1
6	ESC	BCS306x	ESC/ETC/PLC	TD: CS PSB: CS	2	0	1		3	50	50	100	03	3
7	UHV	BCSK307	Social Connect and Responsibility	Any Department	0	0	1		1	100	----	100	------	1
8	AEC/ SEC	BCS358x	Ability Enhancement Course/Skill Enhancement Course-III	TD and PSB: CSE	If the course is a Theory					50	50	100	01	1
					1	0	0		1					
					If a course is a laboratory								02	
					0	0	1		1					
9	MC	BNSK359	National Service Scheme(NSS)	NSS Coordinator	0	0	0		0	100	----	100	-----	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		BYOK359	Yoga	Yoga Teacher										
		BMUK359	Music	Music Teacher										
		BNCK359	National Credit Corps (NCC)	NCC Coordinator										
Total										**550**	**350**	**900**		**21**
Non-Credit Mandatory Course (NCMC) Prescribed to lateral Entry Diploma Students														
10	NCMC	BENGDIP1	**English Communications skill I**	HSS	**0**	**0**	**0**		**0**	**100**	**---**	**100**	**---**	**0**

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

Engineering Science Course (ESC/ETC/PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year)			
BCS306A	OOPS with Java		
BCS306B	OOPS with C++		
Ability Enhancement Course – III			
BCS358A	Data analytics with Excel	BCS358C	Version controller with GiT
BCS358B	Data Analytics with R	BCS358D	Data Visualization with Python

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P: S) can be considered as (3 : 0 : 2 : 0) or (3 : 2 : 0: 0). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

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

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DEPARTMENT OF MATHEMATICS

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

Mathematics III for Computer Science (3:1:0:0) 4

(Common to CSE/ISE/AI&ML)

(Effective from the academic year 2025-26)

Course Code	BCS301	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:1:0:0	SEE Marks	50
Total Hours of Pedagogy	40(Theory) +26(Tutorial)	Exam Hours	03

Course Objectives:

1. To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2. To provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
3. To find the association between attributes and the correlation between two variables.

Teaching-Learning Process

Pedagogy (General Instructions):

Teachers can use the following strategies 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 delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1: Probability Distributions

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. Exponential distribution.

(RBT Levels: L1, L2 and L3) **(10 Hours)**

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Module-2: Joint probability distribution & Markov Chain
Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states. **(RBT Levels: L1, L2 and L3) (10 Hours)**
Module-3: Statistical Inference 1
Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples. **(RBT Levels: L1, L2 and L3) (10 Hours)**
Module-4: Statistical Inference 2
Sampling variables, Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit. F-Distribution. **(RBT Levels: L1, L2 and L3) (10 Hours)**
Module-5: Curve fitting, Correlation, and Regressions
Principles of least squares, Curve fitting by the method of least squares in the form $y= a+bx$, $y=a +bc+cx^2$ and $y=ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation. **(RBT Levels: L1, L2 and L3) (10 Hours)**
Course outcomes: The students will be able to: CO1: Apply discrete and continuous probability distributions in the engineering field. CO2: Apply discrete-time Markov chains and n-step transition probabilities for transitions between states over time. CO3: Employ statistical methodologies in the engineering problem. CO4: Analyze statistical data using correlation and regression methods.
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student securesa minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. **Continuous Internal Evaluation:** • For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks. • The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered. • Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Text books:

1. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2. B. S. Grewal "Higher Engineering Mathematics", Khanna publishers, 44 th Ed., 2021.
3. G Haribaskaran "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, Latest Edition, 2006.
4. Irwin Miller & Marylees Miller, John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8 th edition, 2014.
5. S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.
6. Robert V. Hogg, Joseph W. McKean & Allen T. Craig. "Introduction to Mathematical Statistics", Pearson Education 7 th edition, 2013.
7. Jim Pitman. Probability, Springer-Verlag, 1993.
8. Sheldon M. Ross, "Introduction to Probability Models" 11 th edition. Elsevier, 2014.
9. A.M. Yaglom and I. M. Yaglom, "Probability and Information". D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1983.
10. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, (Reprint), 2003.
11. S. Ross, "A First Course in Probability", Pearson Education India, 6 th Ed., 2002.
12. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 3rd Ed., 1968.
13. N.P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
14. Veerarajan T, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

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

1. Programming Assignment
2. Seminars

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

Digital Design and Computer Organization (3:0:1:0) 4

(Effective from the academic year 2025 -26)

Course Code	BCS302	CIE Marks	50
Teaching Hours/Week(L: T:P:S)	3:0:1:0	SEE Marks	50
Total Number of Contact Hours	40(Theory)+ 26 (Practical)	Exam Hours	03
Examination nature (SEE)	Theory		

Course Objectives:

This course will enable students to:

1. Read and Write Optimize Boolean equations for logic circuits.
2. Design combinational and sequential circuits using MSI components.
3. Simulate and experimentally validate sequential logic circuits.
4. Understand the structure, function, organization and architecture of modern day computing systems.
5. Examine the internal architecture and organization of the processor with an extended discussion of computer arithmetic and the instruction set architecture.

Preamble: Computer System Design course is to familiarize with concepts, design, and practical use of digital circuits and components of computer system. Digital circuits are used in designing Microcontrollers, Microprocessor, Embedded system projects and exposed to hardware design which reflects the current industry requirements.

Module – 1

Introduction to Digital Design: Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, QM method (tabular), Other Hardware Description Language – Verilog/VHDL Model of a simple circuit.

Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9 **(8 Hours)**

Module – 2

Combinational Logic: Introduction, Combinational Circuits, Design Procedure , Binary Adder, Subtractor, Decoders, Encoders, Multiplexers (MEV). HDL Models of Combinational Circuits , Adder, Multiplexer, Encoder. **Sequential Logic**: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.

Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4. **(8 Hours)**

Module – 3

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: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5.

(8 Hours)

Module – 4

Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.

Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1 **(8 Hours)**

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Module – 5	
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. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance. **Text book 2: 7.1, 7.2, 8.1** **Recap/Summary of the Course** **(8 Hours)**	
PRACTICAL COMPONENT OF IPCC	
PART-A **FIXED SET OF EXPERIMENTS** **Experiments Simulation packages preferred: Xilinx, ModelSim, PSpice or any other relevant experiments**	
1	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2	Design a 3- bit full adder and subtractor and simulate the same using basic gates.
3	Design VHDL/Verilog HDL to implement simple circuits using structural, Data flow and Behavioral model.
4	Design Binary Adder-Subtractor – Half adder and Half Subtractor and simulate using VHDL/Verilog HDL.
5	Design Decimal adder and simulate using VHDL/Verilog HDL.
6	Design Different types of multiplexer like 2:1, 4:1 and 8:1 and simulate using VHDL/Verilog program.
7	Design and implement various types of De-Multipler and simulate using VHDL/Verilog.
8	Design and simulate VHDL/Verilog program for implementing various types of Flip-Flops such as SR, JK and D.
PART – B **OPEN ENDED EXPERIMENTS**	
Student is required to design and simulate VHDL/Verilog program for the following: 1. Application of Combinational circuits implementation. 2. Application of Comparators. 3. Application of Encoders or Decoders. 4. Application of Synchronous up/down counters using any Flip Flop.	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Illustrate the functions of the basic processing unit and pipelining. CO2: Interpret the functionality of various devices in communicating with processor and I/O devices. CO3: Apply appropriate techniques to solve and realize the logic expressions for various digital circuits. CO4: Examine the structure and operation of digital circuits using hardware or software tools.	

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Suggested Learning Resources:

Text Books

1. M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog Design, 6e, Pearson Education, 2018.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008.

References:

1. Donald P Leach, Albert Paul Malvino & GoutamSaha, Digital Principles and Applications, Tata McGraw Hill, 6th Edition, 2006.

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

Assign the group task to Design the various types of counters and display the output accordingly Assessment Methods

1. Lab Assessment
2. GATE Based Aptitude Test

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

Operating Systems (3:0:1:0) 4

(Effective from the academic year 2025 -26)

Course Code	BCS303	CIE Marks	50
Teaching Hours/Week (L: T:P:S)	3:0:1:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory) + 26 (Practical)	Exam Hours	03
Examination Nature	Theory		

Course Objectives:

This course will enable students to:

1. To demonstrate the need for OS and different types of OS
2. To discuss suitable techniques for management of different resources
3. To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

Preamble

Operating systems are the fundamental part of every computing device to run any type of software. The increasing use of computing devices in all areas of life (leisure, work), lead to a variety of operating systems. Yet all operating systems share common principles. These principles are important for computer science students in their understanding of programming languages and software built on top of the operating systems.

This course will be discussing about the Address spaces, System call interface, Process/Threads, Inter Process Communication, Deadlock, Scheduling, Main memory, Virtual memory and File systems.

Module – 1

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System operations; Resource Management; Protection and Security; Distributed system; Computing environments.

Operating System Structures: 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 (1.1-1.10), 2 (2.1 2.2-2.8 2.11) (8 Hours)

Module – 2

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication

Threads &Concurrency: Overview; Multithreading models.

CPU Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling.

Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.3), 5 (5.1 -5.5) (8 Hours)

Module – 3

Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Hardware Support for Synchronization; Semaphores.

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), 8 (8.1 -8.8) (8 Hours)

Module – 4

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Memory Management: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table.
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing**.**

Textbook 1: Chapter -9 (9.1-9.5), 10 (10.1-10.6) (8 Hours)

Module – 5

File System:
File-System Interface: File concept; Access methods; Directory structure.
File system implementation: File-System Structure; File-System Operations; Directory implementation; Allocation methods; Free space management.
File-System Internals: File system mounting; Partitions and Mounting; File sharing;
Security and Protection: Goals of protection, Principles of protection, Protection Rings; Domain of protection, Access matrix.
Recap/Summary of the Course
Textbook 1: Chapter – 13 (13.1-13.3), 14 (14.1-14.5), 15(15.1-15.4), 17 (17.1-17.5) (8 Hours)

PRACTICAL COMPONENT OF IPCC

PART A
INTRODUCTORY SECTION – CORE OS FUNCTIONALITIES

1	Write a C program to demonstrate open (), read (), write () and close () system call.
2	Create the following types of files using shell commands and system calls a. soft link (symlink system call) b. hard link (link system call)
3	Write a C program to simulate the process system calls (fork (), exec () and wait (), create process () and terminate process())

PART – B
Shell Scripts

4	Write a shell program which takes two file names as arguments, if their contents are the same then remove the second file.
5	Write a shell program that takes a command line argument and reports on whether it is directory, a file, or something else.
6	Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permission and otherwise output each file name followed by its permissions.
7	Write a shell program to prints the arguments in reverse order
8	Write a shell program to print the prime numbers between the specified range

PART – C

API based programs

1.	Write a C program to implement UNIX ln, mv, rm commands using APIs
2.	Write a program in C to display the contents of a named file on standard output device., Also Write a program to copy the contents of one file to another.
3.	Write a C program that reads every 100th byte from the file, where the file name is given as command line argument
4.	Write a C program to create a process by using fork () and vfork() system call
5.	Write a C program to demonstrate the process is Zombie and to avoid the Zombie process.
6.	Write a C program to create an Orphan Process
7.	Write a C program to demonstrate a parent process that uses wait ( ) system call to catch the child ’s exit code.

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8.	Write a Program to demonstrate race condition.
9.	Write a program to create, writes to, and reads from a pipe. Also Write a program to create a pipe from the parent to child and send data down the pipe.
10.	Write a program to create a semaphore and initialize value to the semaphore. a. Create a binary semaphore b. Create a counting semaphore

Course Outcomes:

The students will be able to:

CO1: Describe the basics of the operating systems services, process, threads and communication

CO2: Apply appropriate scheduling methods for process execution and its management

CO3: Illustrate suitable methods to handle deadlocks and process synchronization

CO4: Analyze memory management techniques and its allocation policies

CO5: Discuss various Implementation of File systems, security mechanism with respect to different storage management technologies

C06: Apply APIs related to Process, Files and IPC to develop operating system applications.

Textbooks:

1. Silberschatz's Operating System Concepts 10Ed Global Edition, Wiley- India, 2023**,** ISBN 13: 978-9357460569

Reference Books:

1. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 5th Edition, Pearson Education, 2024, ISBN-13: 978-0-13-761887-3
2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 8th Edition,2017, ISBN:9781305674257
3. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
4. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
5. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008.

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

Assessment Methods

- Gate Based Aptitude Questions
- Lab Assessment

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B.E. COMPUTER SCIENCE AND ENGINERING

Choice Based Credit System (CBCS)

SEMESTER – III

Data Structure and Applications (3:0:0:0) 3

(Effective from the academic year 2025-2026)

Course Code	BCS304	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory)	Exam Hours	03
Examination Nature	Theory		

Course Objectives:

This course will enable students to:

1. Explain fundamentals of data structures and their applications essential for programming/problem Solving.
2. Utilize an appropriate data structure like Stack, Queues, Lists, Trees and Graphs to solve a given problem.
3. Demonstrate sorting and searching algorithms.

Preamble: Data Structures are a specialized means of organizing and storing data in computers in such a way that we can perform operations on the stored data more efficiently. Data structures have a wide and diverse scope of usage across the fields of Computer Science and many other fields of Engineering. Data Structures are the main part of many computer science algorithms as they enable the programmers to handle the data in an efficient way. It plays a vital role in enhancing the performance of software.

Module – 1

Introduction: Significance and scope of Data Structures, Data Structures and Algorithms in Economic growth of Nation, Impact of Data Structures and Algorithms on societal problems, sustainable solutions, Career perspective of Data Structures and Algorithms, current innovations in Data Structures.

Data Structures: Definition, Classification and Operations, Dynamic memory allocation, Dynamic Arrays, Self-referential structures.

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays.

Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression, Multiple Stacks and Queues. Programming Examples.

Text Book1: Chapter-1:1.2, Chapter-2:2.2,2.3.4, Chapter-3:3.1,3.2,3.6,3.7

Text Book2: Chapter - 1: 1.2,1.3

(8 Hours)

Module – 2

Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular Queues using Dynamic arrays, De-Queues, Priority Queues.

Recursion: Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function

Text Book1 : Chapter-3 : 3.3, 3.4,

Text Book2 : Chapter-6 : 6.3, 6.7,6.8,6.10,6.1.2,6.1.3 **(8 Hours)**

Module – 3

Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection.

Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples.

Text Book1: Chapter-4: 4.1,4.2,4.3, 4.4.1,4.4.2 ,4.7.1,4.8

Text Book2: Chapter-5 **(8 Hours)**

Module – 4

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Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Tree.

Binary Trees: Binary Tree Insert Operation, Binary Tree Traversals - Inorder, Postorder, Preorder, Level Order; Additional Binary tree operations.

Binary Search Trees: BST Insert and Delete operations, Application of Trees - Evaluation of Expression, Programming Examples.

Text Book1: Chapter-5: 5.1 to 5.4,5.7.1,5.7.2,5.7.3,5.7.4 **(8 Hours)**

Module – 5

Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Warshal's Algorithm, Floyds Algorithm, Breadth First Search, Depth First Search.

Hashing: Definition, Hashing Functions, Hash Table, Separate chaining, Collision resolution techniques: Linear Probing, Quadratic Probing, Double Hashing, Rehashing and Applications of Hashing.

Recap: Summary of the Course.

Text Book1: Chapter-6: 6.1,6.2.1,6.2.2,

Text Book2: Chapter-8:8.2,8.3,8.4

Reference Book3: Chapter-15 **(8 Hours)**

Course Outcomes:

The students will be able to:

CO1: Illustrate different types of data structures and its applications.
CO2: Apply linear data structures to solve the given problems.
CO3: Make use of nonlinear data structures in problem solving.
CO4: Develop solutions using different types of data structures to model the real-world problem.

Textbooks

1	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2019
2	Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, 2014.

Reference Books

1	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Cengage Learning, 2nd edition, 2014.
2	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, McGraw Hill, 2nd Edition, 2013.
3	Reema Thareja, Data Structures using C, 3 rd Ed, Oxford press, 2012.

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

1. Problem solving using hackerearth platform

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

DATA STRUCTURES LABORATORY (0:0:1:0) 1

(Effective from the academic year 2025-26)

Course Code	BCSL305	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26(Practical)	Exam Hours	03
Examination Nature	Practical		

Course Objectives:

This course enables students to:

1. Develop linear data structures and their applications such as stacks, queues and lists.
2. Develop non-linear data structures and their applications such as trees and graphs sorting and searching algorithms**.**

Descriptions:

Descriptions: Design, develop, and implement the specified Data Structure as given in the list given below using C Language under LINUX /Windows environment.

Sl. No	PART – A FIXED SET OF EXPERIMENTS
1	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations.
2	Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^ (Power) and alphanumeric operands. Design,
3	Develop and Implement a Program in C for evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^.
4	Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of integers (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations.
5	Design, Develop and Implement a menu driven Program in C for the following operations on Double Ended QUEUE of integers (Array Implementation of Queue with maximum size MAX) a. Perform Insertion / Deletion at front of QUEUE b. Perform Insertion / Deletion at rear of QUEUE c. Display the status of Circular QUEUE d. Exit Support the program with appropriate functions for each of the above operations.

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6	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
7	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, Ph. No. a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue f. Exit.
8	Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
9	Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using any traversal method (DFS/BFS).
10	Given a set of N employee records with a set K of Keys (4-digit) which uniquely determine the records. Assume that the records are available in the memory by a Hash Table (HT) of m-memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K →L as H (K) = K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.
	PART – B **OPEN ENDED EXPERIMENTS**
	Students should develop a program for the given scenario by the course teacher on the following concepts: • Stacks, Queues, Linked lists, Trees, Graphs, and Hashing

Course Outcomes:

The student should be able to:

CO 1: Apply linear data structures to address real-world problems.

CO 2: Apply Non-linear data structures to address real-world problems.

CO 3: Analyse the given problem statement and provide suitable solutions.

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Textbooks	
1	Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2019
2	Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, 2014.
Reference Books	
1	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Cengage Learning, 2nd edition, 2014
2	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, McGraw Hill, 2nd Edition, 2013
3	P Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

OOPS with Java (2:0:1:0)3

(Effective from the academic year 2025-26)

Course Code	BCS306A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:0:1:0	SEE Marks	50
Total Number of Contact Hours	27 (Theory) + 13 (Practical)	Exam Hours	03
Examination Nature	Theory		

Note - Students who have undergone "Basics of Java Programming- 22CS36A" in first year are not eligible to opt this course

Course objectives:

1. To learn primitive constructs JAVA programming language.
2. To understand Object Oriented Programming Features of JAVA.
3. To gain knowledge on: packages, multithreaded programing and exceptions.

Preamble

The purpose of this course is to enable learners to solve problems by breaking it down to object level while designing software and to implement it using Java. This course covers Object Oriented Principles, Object Oriented Programming in Java, Inheritance, Exception handling, Event handling, multithreaded programming and working with window-based graphics. This course helps the learners to develop Desktop GUI Applications, Mobile applications, Enterprise Applications, Scientific Applications and Web based Applications.

Module-1

An Overview of Java: Java Buzzwords, Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles),

Data Types, Variables, and Arrays: The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

Operators: Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

Control Statements: Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).

Text book 1: Chapter 2, 3, 4, 5 **(5 Hours)**

Module-2

Introducing Classes: Class Fundamentals**,** Declaring Objects**,** Assigning Object Reference Variables**,** Introducing Methods**,** Constructors**,** The this Keyword**,** Garbage Collection.

Methods and Classes: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final

Text book 1: Chapter 6, 7 **(6 Hours)**

Module-3

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Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class.
Interfaces: Interfaces, Default Interface Methods.
Text book 1: Chapter 8, 9 **(6 Hours)**

Module-4

Packages: Packages, Packages and Member Access, Importing Packages.
Exceptions: Exception-Handling Fundamentals**,** Exception Types**,** Uncaught Exceptions**,** Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.
Text book 1: Chapter 9, 10 **(5 Hours)**

Module-5

Multithreaded Programming: The Java Thread Model, The Multiple Threads, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Inter thread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State.
Text book 1: Chapter 11 **(6 Hours)**

PART A
FIXED SET EXPERIMENTS

1	**Introduce the java fundamentals, data types, operators and arrays in java** Develop a Java program to add TWO matrices of suitable order N (The value of N should be read from command line arguments) print an error message if N <1 else print the resultant Matrix.
2	**Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables.** As part of a student management system, you are tasked with designing a module to generate student performance reports. Create a Java program using classes that captures a n student's name, roll number, and marks in three subjects. The program should then calculate and display the student's total score along with their details.
3	**Introduce concepts of method overloading, constructor overloading** You are building a user authentication module for a web application. The system should support different ways of user login and account creation. Implement a class User that demonstrates constructor overloading for different account creation types and method overloading for flexible login options. Create multiple constructors in the User class: User(String username, String password)– Creates a standard user. User(String username, String password, String email)– Creates a user with email verification Methods : Login(String username, String password): returns true if credentials are matching Login(String username, String password, int otp): returns true if credentials and otp are matching Write a Java program to Create the users and login with proper credentials.
4	**Demonstrate the core object-oriented concept of Inheritance, polymorphism** Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display staff object of all three categories.
5	**Introduction to abstract classes, abstract methods** Develop a JAVA program to create an abstract class/interface Shape with abstract methods calculate Area() and calculate Perimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.

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6	**Introduce the concept of Abstraction, packages.** Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR) and time converter (hours to minutes, hours to seconds) using packages.

PART B
OPEN ENDED EXPERIMENTS

Students should develop a program for the given scenario by the course teacher on the following concepts.

1. Application of interfaces in real world scenario.
2. Built-in and user defined exception handling.
3. Creating user defined Threads.

Course outcome (Course Skill Set)

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

CO1: Demonstrate the fundamentals of Java programming constructs.
CO2: Apply the concepts of object-oriented features for enhancing code reusability
CO3: Illustrate the concept of packages and exception handling mechanism in solving complex problems.
CO4: Make use of multi-threading concepts in program development.
CO5: Develop solutions for given scenario using Java concepts.

Textbook

1. Java: The Complete Reference, 12th Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

Reference Books

1. Programming with Java, 6th Edition, by E Balagurusamy, March 2019, McGraw Hill Education, ISBN: 9789353162337.
   Thinking in Java, FourthEdition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

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

1. Group Assignment to develop small projects and demonstrate using Java

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B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

OOPS with C++ (2:0:1:0) 3

(Effective from the academic year 2025 -26)

Course Code	BCS306B	CIE Marks	50
Teaching Hours/Week (L: T:P:S)	2:0:1:0 (Integrated)	SEE Marks	50
Total Number of Contact Hours	27 (Theory) + 13(Practical)	Exam Hours	03
Examination Type	Theory		

Note - Students who have undergone " Introduction to C++ Programming BPLCK105D/205D" in first year are not eligible to opt this course

Course Objectives:

This course will enable students to:

1. To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.
2. To illustrate the capability of a class to rely upon another class and functions.
3. To Create and process data in files using file I/O functions
4. To understand the generic programming features of C++ including Exception handling

Preamble

Object oriented programming is an approach that provides a way of modularizing programs by creating partitioned memory area for both data and functions that can be used as templates for creating copies of such modules on demand. OOP is a base for learning Programming with the rapid changes in technology, there is an increasing need to keep the academia abreast of the skill set requirement of the industry. These concepts are important for computer science students in their understanding of programming languages. This course will be discussing Objects, Classes, Polymorphism, Encapsulation, data abstraction Inheritance etc.

Module – 1

An overview of C++: What is object-Oriented Programming, Introducing C++ Classes, The General Form of a C++ Program. Classes and Objects: Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment

(5 Hours)

Module – 2

Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members. **Functions Overloading, Copy Constructors:** Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.

(6 Hours)

Module – 3

Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, **Overloading new and delete Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes , Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes

(6 Hours)

Module – 4	
Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. **Templates**: Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates **(5 Hours)**	
Module – 5	
Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. **The C++ I/O System Basics:** C++ Streams, The C++ Classes, Formatted I/O File I/O: and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF, **(6 Hours)**	
Course Outcomes: The students will be able to:	
CO1: Apply object-oriented programming constructs to develop structured and efficient solutions for computing problems. CO2: Analyze program structure and relationships among components to ensure modularity, extensibility, and reusability in software design. CO3: Examine the use of polymorphism, virtual functions, and generic programming techniques to improve flexibility and adaptability of solutions. CO4: Inspect program behavior in terms of error handling, file operations, and data management to ensure robustness and reliability. CO5: Evaluate problem-solving strategies by implementing object-oriented solutions in C++ to ensure efficiency, scalability, and correctness.	
Practical Component	
PART – A **FIXED SET OF EXPERIMENTS**	
1	You are building a feature for an e-commerce platform that displays product prices. Write a C++ program that accepts a list of product prices and displays them sorted both in ascending (low to high) and descending (high to low) order, allowing customers to choose how they want to view the prices." (Use basic programming concepts like looping constructs for menu driven programming, arrays and sorting logic etc.)
2	As part of a student management system, you are tasked with designing a module to generate student performance reports. Create a C++ program using classes that captures a student's name, roll number, and marks in three subjects. The program should then calculate and display the student's total score along with their details. (Use C++ concepts like classes, constructors and methods etc.)
3	You are developing a contact management application where each contact contains details such as name, phone number, and email address. To ensure safe and accurate duplication of contact records (e.g., for backup or editing), implement a C++ class Contact that: 1. Includes a copy constructor to properly copy all data members from one contact object to another. 2. Also includes a destructor to manage clean-up when a contact object is destroyed (e.g., to release memory or display a message indicating the object is being deleted). Demonstrate the creation of an original contact and a copy using the copy constructor,

	display their contents, and show how the destructor is automatically invoked when objects go out of scope. (Use C++ concepts like classes, constructors, copy constructor, destructor etc.)
4	Develop a loan eligibility evaluation system for a bank. The system has two classes: Customer – contains private data members such as name, account balance, and credit score. Loan – is responsible for evaluating whether the customer is eligible for a loan based on specific criteria (e.g., balance ≥ ₹50,000 and credit score ≥ 750 out of 1000). Since the Loan class should not directly access the private members of the Customer class, implement a friend function named checkEligibility() that can access the private data of Customer and evaluate the eligibility. (Use C++ concepts like classes, constructor, Friend functions etc.)
5	You are developing a banking application that enables customers to manage their accounts efficiently. As part of the system implement the following functionality: 1. Implement function overloading to perform addition of both integer-based amounts (e.g., ₹500 + ₹200) and floating-point values (e.g., ₹1000.75 + ₹499.25), ensuring accuracy across transaction types like deposits and interest calculations. 2. Use operator overloading to redefine the unary minus (-) operator, allowing quick reversal of transaction values — for example, converting a credit transaction into a debit during a refund or correction. (Use concepts like classes, function overloading and operator overloading etc.)
6	You are designing a modular calculator system where arithmetic functionalities are separated into logical units. One class provides addition functionality, another provides subtraction, and a third class inherits from both to perform a full arithmetic operation on two numbers. Implement a C++ program using multiple inheritances to demonstrate this system. (Use concepts like classes, constructors, multiple inheritances etc.)
7	"You're working on a scientific computation module where different values—such as alpha, beta, and gamma—represent coefficients in a formula. These values come from different sources: a base class initializes alpha and beta, while the derived class introduces gamma. Write a C++ program using constructors in derived classes to properly initialize and display all three values, showcasing inheritance and constructor chaining." (Use concepts like classes, constructors, inheritance and constructor chaining etc.)

PART – B
OPEN ENDED EXPERIMENTS

Students should develop a program for the given scenario by the course teacher on the following concepts.

1. File operation in C++
2. Built-in & User Defined Exception Handling

Textbooks:

1. Herbert schildt, The Complete Reference C++, 4 th edition, TMH, 2005.

References:

1. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill
2. Education Pvt.Ltd., Sixth Edition 2016.
3. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
4. A K Sharma , "Object Oriented Programming with C++", Pearson Education, 2014.

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

1. Group Assignment to develop small projects and demonstrate using C++

Department of Humanities and Social Sciences

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

(Common to all branches)

Social Connect and Responsibility(0:0:1:0)1

(Effective for 2022 Scheme)

Course Code	BCSK307	CIE Marks	**100**
Teaching Hours/Week (L: T:P)	0:0:1:0	SEE Marks	-
Total Number of Contact Hours	26 Hours	Exam Hours	**-**
Credits	01 – Credit		

Course objectives: The course will enable the students to:

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.

Social Connect & Responsibility –All Modules Activity Based Learning

Module-1

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. **(04 Hours)**

Module-2

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes. **(05 Hours)**

Module-3

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes. **(06 Hours)**

Module-4

Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes. **(06 Hours)**

Module-5

Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. **(05 Hours)**

Course outcomes (Course Skill Set): 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 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 among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

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 conversional 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 26 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 mentor. Faculty mentor 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**.**

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 Examination (SEE) – Completely Practical and activities-based evaluation**

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	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	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	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	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	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	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
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.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**
Field Visit, Plan, Discussion	10 Marks
Commencement of activities and its progress	20 Marks
Case study-based Assessment Individual performance with report	20 Marks
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**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

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.

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

Data Analytics with Excel (0:0:1:0) 1

(Effective from the academic year 2025-26)

Course Code	BCS358A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26 (Practical)	Exam Hours	02
Examination Type	Practical		

Course objectives: The course will enable the students to:

1. To Apply analysis techniques to datasets in Excel
2. Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
3. Understand and Identify the principles of data analysis
4. Become adept at using Excel functions and techniques for analysis
5. Build presentation ready dashboards in Excel

Sl. No	PART- A FIXED SET OF EXPERIMENTS
1	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions. Create a student spreadsheet with the following columns NAME | USN | SEMESTER | MOBILE NO | EMAIL | FEES | MARKS-1 | MARKS-2 | MARKS-3 | ASSIGNMENT-1 | ASSIGNMENT-2 Note: Leave the MARKS entry blank if the student is absent, leave the ASSIGNMENT entry blank if the student has not submitted the assignment 1) Insert details of 20 students 2) Insert the currency symbol ₹ or $ before fees 3) Demonstrate insertion of single and multiple rows 4) Insert the columns as mentioned below a) column “AGE” in between “MOBILE NO” and “EMAIL” b) columns “SL No” before “NAME” c) column “AVERAGE MARKS” between “MARKS-3” AND “ASSIGNMENT-1” d) column “FINAL SCORE” after “ASSIGNMENT-2” 5) Find the AVERAGE MARKS scored by each student and FINAL SCORE of all students 6) Find the max score and min score 7) Find the number of students Present for Test-1 8) Find the number of students Absent for Test-2 9) Find the number of students who have submitted ASSIGNMENT-1 10) Find the number of students who have NOT submitted ASSIGNMENT-2
2	Working with Data : Importing data, Data Entry & Manipulation, Sorting & Filtering. Consider the student spreadsheet with columns as shown USN | FIRST NAME | LAST NAME | DEPARTMENT | FEES | MARKS OUT OF 100 | RESULT | GRADE-NIF | GRADE-SWITCH | GRADE-IFS | HOD | SCHOLARSHIP 1) Find the result of student PASS / FAIL using Simple IF 2) Fill GRADE-NIF column using Nested IF

3) Fill GRADE-SWITCH column using SWITCH
4) Fill GRADE-IFS column using Nested IFS
5) Use HLOOKUP for the below table and Find the HOD based on Department

DEPARTMENT	CSE	ISE	AIML	CSBS
HOD	TS	TNM	AHS	VK

6) Use VLOOKUP for the below table and Find the Scholarship based on Grade

GRADE	SCHOLARSHIP
O	10000
A	8000
B	6000
C	4000
D	2000
F	0

7) Find the highest marks and lowest marks department wise and fill in the below table using MAXIFS and MINIFS

DEPARTMENT	HIGHEST MARKS	LOWEST MARKS
CSE		
ISE		
AIML		
CSBS		

8) Use Conditional Formatting for the "FEES" column,
a) Highlight all cells with FEES > 100000 with green colour
b) Highlight all cells with FESS between 75000 to 99999 with blue colour
c) Highlight all cells with FESS < 75000 with red colour

9) Use conditional formatting for the Result column,
a) Highlight all cells with "PASS" with green colour
b) Highlight all cells with "FAIL" with red colour

3

Working with Data: Data Validation, Pivot Tables & Pivot Charts.
Experiment-3
Consider the student spreadsheet with columns as shown

NAME (,)	FIRST NAME	LAST NAME	FULL NAME	FIRST NAME-FF	LAST NAME-FF	FULL NAME-FF

FULL NAME-LOWER	FULL NAME UPPER	FULL NAME PROPER	GENDER	GENDER CODE	USN	BRANCH CODE	GRADE	GRADE CODE

DATE OF BIRTH	DATE	MONTH	YEAR	EMAIL	MARKS	IN CELL CHART FOR MARKS	TECHINCAL SKILL RATING	STAR RATING

	1) Find the FIRST NAME and LAST NAME of all students TEXT TO COLUMN WIZARD 2) Find the FULL NAME of all students CONCAT 3) Find the FIRST NAME-FF, LAST NAME-FF, FULL NAME-FF using Flash Fill 4) Find the full Name in lower case, upper case and proper case 5) Fill the GENDER CODE F – for Female and M – for Male Use LEFT Function 6) Fill the BRANCH CODE from USN Use MID function 7) Fill the GRADE CODE from GRADE Use RIGHT function 8) Convert the date to long format and Extract the DATE, MONTH and YEAR using Flash Fill 9) Generate the email id for all students which is of the format FIRSTNAME_LAST NAME.USN@ bmsit.in all in lower case 10) Create a in cell chart for MARKS Use REPT function and then use Playbill font 11) Fill the STAR RATING column based on TECHNICAL SKILL RATING INSERT → SYMBOL→ (IN WINGDINGS-2) STAR SYMBOL USE REPT FUNCTION to get STAR RATING
4	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs. 1) Format data by assigning suitable data types – number, date, text, currency 2) Remove blank rows and duplicate rows Find and Select → go to special → Blanks → all blank rows will be selected Go to delete option → delete sheet rows Data →Remove duplicates 3) Create a table for the given sheet on a separate sheet a) Demonstrate filtering of data based on DEPARTMENT b) Sort the data in ascending order of NAME 4) Create a Pivot Table displaying the number of students in each department semester wise. 5) Create a Pivot Table displaying the summary of fees department wise and under each department semester wise. 6) Create a slicer for the pivot table obtained in 5) for the fields “DEPARTMENT” and “SEMESTER” 7) Create a Pivot Table displaying the open elective subjects and department wise count of students who have opted for the subject 8) Create a slicer for the pivot table obtained in 7) for the fields “DEPARTMENT” and “OPEN ELECTIVE”
5	Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate. Bar graphs – Horizontal and Vertical: For Comparison (compare things between different groups) 1) Draw a suitable graph depicting the Total Fee department wise. Pie Charts – (Part to whole analysis - use when you are trying to compare parts of a whole) 2) Draw a suitable graph depicting the % of fees as part of whole fee department wise. Line Graph – Trend Analysis (used to track changes over short and long periods of time) 3) Draw suitable graphs depicting the average marks of all students over 6 semesters department wise.

USN	NAME	DOB	SEMESTER	DEPARTMENT	TUITION FEE	COLLEGE FEE	SPORTS FEE	MISC FEE	OPEN ELECTIVE

USN	NAME	DEPARTMENT	TUITION FEE	SPORTS FEE	TOTAL FEE	SEM-1 MARKS	SEM-2 MARKS	SEM-3 MARKS	SEM-4 MARKS	SEM-5 MARKS	SEM-6 MARKS	SALARY PACKAGE	Attendance %

<table>
<tr><td></td><td>Histograms – Frequency distribution analysis
4) Draw suitable graphs depicting the range of SALARY PACKAGE department wise
5) Draw a progress bar depicting the attendance % of all students</td></tr>
<tr><td>6</td><td>Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
Create the sheets November and December and enter the data appropriately
Group all sheets from January to December and change the year to 2023
Update the Expenses Summary sheet by including the details of November and December month
Create a Monthly Income Summary sheet giving the details as shown below
<table>
<tr><td>MONTH</td><td>TOTAL MONTHLY INCOME</td></tr>
<tr><td>January</td><td>Rs.</td></tr>
<tr><td>February</td><td></td></tr>
<tr><td>..</td><td></td></tr>
<tr><td>..</td><td></td></tr>
<tr><td>DECEMBER</td><td></td></tr>
</table></td></tr>
<tr><td>7</td><td>Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
<table>
<tr><td>Student ID</td><td>Student Name</td><td>fees</td><td>DOJ</td><td>Department</td><td>Address</td></tr>
</table>
Assume Student ID is a 4-digit number ranging from 1111 to 9999, Prompt the user to enter a Student ID when the cell is selected and validate the entered Student ID. Display an error message “Invalid Student ID” if the entered details are not in the given range.

The name of the student is restricted to have a maximum of 20 characters to fit in the ID card. Suitably validate the Student Name field in the sheet and display an error message “Maximum 20 characters allowed” if the entered name is exceeding 20 characters.

The fees is a decimal number ranging from 10000.00 to 100000.00, Prompt the user to enter the fee details, and validate the entered fees. Display an error message “Invalid Fees” if the entered details are not in the given range.

DOJ is the date of joining the institution and is to be between 1/08/2023 to 31/09/2023. Suitably validate the DOJ field in the sheet and display an error message “Invalid date of joining” if the entered DOJ is not in the given range.

Department is one among CSE / ISE / AIML / CSBS. Provide a list option for the user to select the department and validate suitably.

Address is to be entered in capital letters only. Suitably validate the address field in the sheet and display an error message “Not Capital” if address is not entered in capital letters.

Enter valid data for 10 students, demonstrate locking/unlocking cells and Protect the sheet with a password.</td></tr>
<tr><td>8</td><td>Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.</td></tr>
</table>

Consider the following sheet which gives the details of selling a product

Selling Price per Unit	32
Quantity Sold	100
Total Selling Price	3200
Transportation Cost	320
Manufacturing cost per Unit	20
Total Cost Incurred	2320
Profit	880

1. For the above scenario, analyze what will be the profit obtained when the Quantity Sold is 200, 300 and 400 by creating 3 different scenarios and summarize the results obtained.
2. For the above scenario, analyze the quantity of products that need to be sold to get a profit of 10000 using goal seek.
3. For the above scenario, find the selling price per unit to get a profit of 2000 keeping the quantity sold as 100.
4. For the above scenario, create a data table listing the profits for quantity = 200, 300, 400, ……, 1000

Qty	
200	
300	
400	
500	
600	
700	
800	
900	
1000	

Extend the above data table for selling price per unit = 30, 40, ….., 80 along with profits for quantity = 200, 300, 400, ……, 1000

	30	40	50	60	70	80
200						
300						
400						
500						
600						
700						
800						
900						
1000						

PART- B OPEN ENDED EXPERIMENT	
1.	Develop a dashboard for any dataset using Pivot Tables, charts and dashboard layout with interactive element slicers.

The student should be able to:

CO1: Choose functions and productivity tools to assist in developing worksheets.

CO2: Create and manipulate data lists using Outline and PivotTables in Microsoft Excel.

CO3: Utilize Consolidation features to summarize and report results from multiple worksheets.

CO4: Apply Macros and Auto-filter to solve the given real-world scenario.

References

1.	Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Office 2007®, Third Edition, © 2010 Brooks/Cole, Cengage Learning, ISBN-13: 978-0-495-39178-4
2.	Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modelling, PHI, ISBN: 9789389347180
3.	Aryan Gupta - Data Analysis in Excel: The Best Guide. (https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel)

B.E. COMPUTER SCIENCE AND ENGINERRING

Choice Based Credit System (CBCS)

SEMESTER – III

Data Analytics with R (0:0:1:0) 1

(Effective from the academic year 2025-26)

Course Code	BCS358B	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26(Practical)	Exam Hours	02
Examination Nature (SEE)	Practical		

Course Objectives:

This course will enable students to:

1. To explore and understand how R and R Studio interactive environment.
2. To understand the different data Structures, data types in R.
3. To learn and practice programming techniques using R programming.
4. To import data into R from various data sources and generate visualizations.
5. To draw insights from datasets using data analytics techniques.

Preamble: R analytics is data analytics using R programming language, an open-source language used for statistical computing or graphics. This programming language is often used in statistical analysis and data mining It can be used for analytics to identify patterns and build practical models.

Sl. No	PART –A FIXED SET OF EXPERIMENTS
1	Demonstrate the steps for installation of R and R Studio. Perform the following: a) 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. b) Demonstrate Arithmetic and Logical Operations with simple examples. c) Demonstrate generation of sequences and creation of vectors. d) Demonstrate Creation of Matrices e) Demonstrate the Creation of Matrices from Vectors using Binding Function. f) Demonstrate element extraction from vectors, matrices and arrays **Suggested Reading** – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – RStudio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables)

2	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: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. 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. **Suggested Reading** – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)
3	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication **Suggested Reading** – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)
4	Develop a program to find the factorial of given number using recursive function calls. **Suggested Reading** – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes. **Suggested Reading** – Reference Book 1 - Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: a) Find the Pearson and Spearman correlation coefficients. Are they similar? b) Plot the data using the plot command. c) Plot the logarithm (log) of each variable and see if that makes a difference. **Suggested Reading** – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots) Reference Book 2 – 13.2.5 (Covariance and Correlation)

7	Develop R program to create a Data Frame with following details and do the following operations. <table><tr><th>itemCode</th><th>itemCategory</th><th>itemPrice</th></tr><tr><td>1001</td><td>Electronics</td><td>700</td></tr><tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr><tr><td>1003</td><td>Office Supplies</td><td>350</td></tr><tr><td>1004</td><td>USB</td><td>400</td></tr><tr><td>1005</td><td>CD Drive</td><td>800</td></tr></table> a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350. b) Subset the Data frame and display only the items where the category is either “Office Supplies” or “Desktop Supplies” c) Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames **Suggested Reading** –Textbook 1: Chapter 5 (Lists and Data Frames)
8	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. a) Assigning names, using the air quality data set. b) 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 **Suggested Reading** –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothing and Shading)
9	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” **Suggested Reading** – Text Book 1 – Chapter 12(CSV and Tab Delimited Files)

10	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 axleratio,[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?
11	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. **Suggested Reading** – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction)

PART- B
OPEN ENDED EXPERIMENT

1. Develop a dashboard for any dataset using Flex UI libraries

Course outcomes:

The students will be able to:

CO1: Illustrate the fundamental syntax of R data types, expressions and the usage of the R-Studio IDE.
CO2: Develop a program in R with programming constructs: conditionals, looping and functions.
CO3: Apply the list and data frame structure of the R programming language.
CO4: Use visualization packages and file handlers for data analysis.

Textbooks

1. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc.

References

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.
2. Davies, T.M. (2016) The Book of R: A First Course in Programming and Statistics. No Starch Press.

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III

VERSION CONTROLLER WITH GIT (0:0:1:0) 1

(Effective from the academic year 2025-26)

Course Code	BCS358C	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26(Practical)	Exam Hours	02
Examination Nature	Practical		

Course Objectives:

This course will enable students to:

1. Familiar with the basic command of Git.
2. Create and manage branches.
3. Understand how to collaborate and work with Remote Repositories.
4. Familiar with version controlling commands.

Preamble

In today's fast-paced world of software development and project management, the ability to efficiently manage your project's source code and collaborate with team members is crucial. Git has become the industry standard for version control, enabling seamless project tracking, code collaboration, and problem resolution.

Sl. No	PART-A FIXED SET OF EXPERIMENTS
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.
2	**Creating and Managing Branches** Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	**Creating and Managing Branches** Write the commands to stash your changes, switch branches, and then apply the stashed changes.
4	**Collaboration and Remote Repositories** Clone a remote Git repository to your local machine.
5	**Collaboration and Remote Repositories** Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
6	**Collaboration and Remote Repositories** Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
8	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
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?
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."

11	**Analysing and Changing Git History** Write the command to display the last five commits in the repository's history.
12	**Analysing and Changing Git History** Write the command to undo the changes introduced by the commit with the ID "abc123".
	PART- B **OPEN ENDED EXPERIMENT**
2.	Build a custom dashboard to visualize Git repository metrics.

Course outcomes:

The students will be able to:

CO1: Use the commands related to Git repository

CO2: Create and manage the branches

CO3: Apply commands related to Collaboration and Remote Repositories

CO4: Analyze and change the Git history

Textbooks	
1.	Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
2.	Pro Git book, written by Scott Chacon and Ben Straub and published by Apress https://git-scm.com/book/en/v2
References	
1.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_sha red/overview
2.	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_sh ared/overview

B.E. COMPUTER SCIENCE AND ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER -III

Data Visualization Using Python (0:0:1:0) 1
(Effective from the academic year 2025-26)

Course Code	BCS358D	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26(Practical)	Exam Hours	02

Course Objectives:

This course will enable students to:

1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications
2. Using Python programming language to develop programs for solving real-world problems
3. Implementation of Matplotlib for drawing different Plots
4. Demonstrate working with Seaborn, Bokeh.
5. Working with Plotly for 3D, Time Series and Maps.

PART –A
FIXED SET OF EXPERIMENTS

1. a) Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib.
1. b) Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.

2. a) Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib.
2. b) Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.

3. a) Write a Python program to illustrate Linear Plotting using Matplotlib.
3. b) Write a Python program to illustrate liner plotting with line formatting using Matplotlib.

4. Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions.

5. a) Write a Python program to explain working with bokeh line graph using Annotations and Legends.
5. b) Write a Python program for plotting different types of plots using Bokeh.

6. Write a Python program to draw 3D Plots using Plotly Libraries.

7. a) Write a Python program to draw Time Series using Plotly Libraries.
7. b) Write a Python program for creating Maps using Plotly Libraries

8. Write a Python program to animate sine wave using matplotlib.animation

9. Write a Python program to animate the word "BMS" using matplotlib.animation

PART- B
OPEN ENDED EXPERIMENT

1. Develop a dashboard for any dataset using python tools.

Course outcomes:

CO1. Apply Matplotlib, Seaborn, Bokeh, Animations for visualization.
CO 2. Analyse plotly for plotting time series data.
CO 3. Develop a dashboard for visualization using any dataset.

Text books:

1.Mario Dobler, Tim Großmann, Data Visualization with Python: Create an impact with meaningful data insights using interactive and engaging visuals, Packt Publishing Limited, 2019.
2. Jake VanderPlas "Python Data Science Handbook" 1st Edition, O'REILLY, 2016.

Department of Humanities and Social Sciences

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III to VI

National Service Scheme(NSS) (0:0:0:0) 0

(Common to all branches)

(Effective from the academic year 2025-26)

Course Code	**BNSK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:0:0	SEE Marks	-
Total Number of Contact Hours	26(Practical)	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives: National Service Scheme (NSS) will enable the students 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

Introduction to NSS

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers.

(04 Hours)

Module – 2

Overview of NSS Programs

Objectives, special camping – Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed.

(**04 Hours)**

Module – 3

NSS Activities - Group Contributions to Society / community (Activity based Learning)

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management– Public, Private and Govt. organization, 5 R's. Water conservation techniques – role of different stakeholders – implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

(06 Hours)

Module – 4

National Level Activities for Society / Community at large (Activity based Learning)

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. **(06 Hours)**

Module – 5

Individual Activities for Local Voice (Activity based learning)

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events. **(06 Hours)**

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyze the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Teaching Practice:

1. Classroom teaching (Chalk and Talk)
2. ICT – Power Point Presentation
3. Audio & Video Visualization Tools

Weightage	**CIE – 100%**
Presentation -1 Selection of topic, PHASE-1	20 Marks
Commencement of activity and its progress– PHASE – 2	20 Marks
Case Study based Assessment – Individual performance	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of the course with Report	20 Marks

Suggested Learning Resources:

Books:

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

Department of Humanities and Social Sciences

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III to VI

SPORTS (0:0:0:0) 0

(Common to all Branches)

(Effective from the academic year 2025-26)

Course Code	BPEK359/459/559/659	CIE Marks	100
Teaching Hours/Week (L: T:P:S)	0:0:0:0	SEE Marks	--
Total Number of Contact Hours	26(Practical)	Exam Hours	--

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

1.

Course Objectives: The course will enable students to

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. Focus on modern technology in sports.

Module – 1

Introduction of the game: Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

(06 Hours)

Module – 2

Overview of NSS Programs

Offensive and Defensive Techno Tactical Abilities: Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities (**05 Hours)**

Module – 3

NSS Activities - Group Contributions to Society / community (Activity based Learning)

Team tactics and Rules of the Game: Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment. **(05 Hours)**

Module – 4

Sports Training: Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts, Medium and Long term, Physiological changes: Changes in Lung capacity, heart beats etc. **(05 Hours)**

Course outcomes:

The students will be able to:

1. Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.
2. Develops individual and group techno tactical abilities of the game.

3. Increases the team combination and plan the strategies to play against opponents.
4. Outline the concept of sports training and how to adopt technology to attain high level performance.
5. Summarize the basic principles of organising sports events and concept of technology implemented to organise competitions in an unbiased manner.

Teaching Practice:

1. Classroom teaching (Chalk and Talk)
2. ICT – Power Point Presentation and video analysing.
3. Practical classes in outdoor and indoor as per requirement.

CIE: 100 Marks

1. CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
2. CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

Textbooks

1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. **Pankaj Vinayak Pathak, "*Sports and Games - Rules and Regulation*", 2019, Khel Sahitya Kendra.**
3. Hardayal Singh, *"Sports Training, General Theory & Methods"*, 1984 "Netaji Subhas, National Institute of Sports".
4. Keith A. Brown, "International Handbook of Physical Education and Sports Science",

Reference books

1. Tudor O Bompa,*" Periodization Training for Sports*", 1999, Human Kinetics, USA
2. Michael Boyle, "New Functional Training for Sports" 2016, Human Kinetics USA
3. Michael Kjaer, Michael Rogsgaard, Peter Magnusson, Lars Engebretsen & 3 more, "Text book of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity", 2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, "Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50)

Department of Humanities and Social Sciences

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – III to VI

Yoga (0:0:0:0) 0

(Common to all Branches)

(Effective from the academic year 2025-2026)

Course Code	**BYOK359/459/559/659**	CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:0:0	SEE Marks	-
Total Number of Contact Hours	26(Practical)	Exam Hours	-

Course Objectives:

This course will enable students to:

1. Understand the importance of practicing yoga in day-to-day life.
2. Be aware of therapeutic and preventive value of Yoga.
3. Have a focussed, joyful and peaceful life.
4. Maintain physical, mental and spiritual fitness.
5. Develop self-confidence to take up initiatives in their lives.

Module – 1

Introduction to Yoga: Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes. **(04 Hours)**

Module – 2

Physical Health: Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes.

(06 Hours)

Module – 3

Psychological Health: Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes. **(06 Hours)**

Module – 4

Therapeutic Yoga: Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes.

(06 Hours)

Module – 5

Spirituality & Universal Mantra: Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **(04 Hours)**

Course Outcomes:

Students will be able to:

1. Understand the requirement of practicing yoga in their day-to-day life.
2. Apply the yogic postures in therapy of psychosomatic diseases
3. Train themselves to have a focussed, joyful and peaceful life.
4. Demonstrate the fitness of Physical, Mental and Spiritual practices.
5. Develops self-confidence to take up initiatives in their lives.

Teaching Practice:

1. Classroom teaching (Chalk and Talk)
2. ICT – Power Point Presentation
3. Audio & Video Visualization Tools

CIE: 100 Marks

1. CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
2. CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student have to perform asanas.

Textbooks

1. George Feuerstein: The yoga Tradition (Its history, literature, philosophy and practice.)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind. (Orient paper Backs: vision Books Pvt.Ltd., 1982.
3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications India Pvt.,Ltd., New Delhi.)
4. Science of Divinity and Realization of Self – Vethathiri Publication, (6-11) WCSC, Erode

References

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited, ISBN: 9781909141209, 9781909141209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi, 2009
3. Dr. HR. Nagendra: Yoga Research and applications (Vivekanda Kendra Yoga Prakashana Bangalore), 1999
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore), 2014

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
B.E. COMPUTER SCIENCE AND ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – III to VI

Music (0:0:0:0) 0
(Common to all Branches)
(Effective from the academic year 2025-2026)

Course Code	BMUK359/459/559/659	CIE Marks	100
Teaching Hours/Week (L: T:P:S)	0:0:0:0	SEE Marks	-
Total Number of Contact Hours	26(Practical)	Exam Hours	-

Mandatory Course (Non-Credit)
(Completion of the course shall be mandatory for the award of the Degree)

Course Objectives:

The course will enable the students to:

1. Identify the major traditions of Indian music, both through notations and aurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety of settings.

Module – 1

Preamble: Contents of the curriculum intend to promote music as a language to develop an analytical, creative, and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition.

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **(03 Hours)**

Module – 2

Compositions: Introduction to the types of compositions in Carnatic Music - Geethe, Jathi Swara, Swarajathi, Varna, Krithi, and Thillana, Notation system.

(03 Hours)

Module – 3

Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya. **(03 Hours)**

Module – 4

Music Instruments: Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments

(03 Hours)

Module – 5

Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethein Malahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song **(14 Hours)**

Course Outcomes (COs):

The students will be able to:

CO1: Discuss the Indian system of music and relate it to other genres (Cognitive Domain)
CO2: Experience the emotions of the composer and develop empathy (Affective Domain)
CO3: Respond to queries on various patterns in a composition (Psycho-Motor Domain)

Teaching Practice:

1. Classroom teaching
2. ICT – PowerPoint Presentation
3. Audio & Video Visualization Tools

CIE: 100 Marks

1. **CIE 1** for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester
2. **CIE 2** for 60 marks – A practical test conducted at the end of the semester in which the student has to recite one Sarale Varase mentioned by the examiner in three speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara / Krithi.

Textbooks

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana - Vol. 1 (English), Shreenivaasa Prakaashana, 2018.

References

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: A Practical Guide", Tranquebar 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, National Institute of Open Schooling, 2019.

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
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Choice Based Credit System (CBCS)
SEMESTER – III to VI

National Cadet Corp (NCC) (0:0:0:0) 0
(Common to all Branches)
(Effective from the academic year 2025-2026)

Course Code	BNCK359/459/559/659	CIE Marks	100
Teaching Hours/Week (L:T:P:S)	0:0:0:0	SEE Marks	-
Total Number of Contact Hours	26(Practical)	Exam Hours	-

Mandatory Course (Non-Credit)
(Completion of the course shall be mandatory for the award of degree)

Course Objectives:
This course will enable students to:
1. Understand the vision of NCC and its functioning.
2. Understand the security set up and management of Border/Coastal areas.
3. Acquire knowledge about the Armed forces and general awareness.

Module– 1

Introduction to National Cadet Corp: What is NCC, who can join NCC, benefits, Establishment, history, 3 wings, motto, core values, Aims, flag, song, pledge, cardinals, Organization, Director General NCC, Directorates, Uniform and Cadet ranks, Camps, Certificate exams, Basic aspects of drill.
National Integration: Importance of national integration**,** Factors affecting national integration, Unity in diversity**,** Role of NCC in nation building.
Disaster Management: What is a Disaster**,** Natural and Man-made disasters**,** Earthquake, Floods. **(04 Hours)**

Module– 2

Indian Army: Introduction to Indian Army, Command and control, Fighting & supporting arms**,** Rank structure, Major Regiments of the Army**,** Major Wars and Battles**,** Entry to the Indian Army, Renowned leaders and Gallantry Awardees.

(02 Hours)

Module– 3

Indian Air Force: Introduction to Indian Air Force, Command and control**,** Rank structure**,** Major Aircrafts, Entry to the Indian Air Force, Renowned leaders.

Indian Navy: Introduction to Indian Navy, Command and control, Rank structure, Major Ships and Submarines**,** Entry to the Indian Navy, Renowned leaders. **(02 Hours)**

Module– 4

Health and Hygiene: First Aid Protocols - CPR, Understanding Types of Bandages, Fire Fighting
Field & Battle Crafts: Field Signals using hands, Judging distance -Types of Judging Distance, Section formations-types of Section Formation **(10 Hours)**

Module– 5

Drill Practicals: Savdhan, Vishram, Salute, Turning, Marching.

(08 Hours)

Course outcomes:

The students will be able to:

CO1: Develop qualities like character, comradeship, discipline, leadership, secular outlook, spirit of adventure, ethics and ideals of selfless service.

CO2: Get motivated and trained to exhibit leadership qualities in all walks of life and be always available for the service of the nation.

CO3: Familiarize on the issues related to social & community development and disaster management and equip themselves to provide solutions.

CO4: Get an insight of the defense forces and further motivate them to join the defense forces.

Teaching Practice:

1. Blackboard/Multimedia Assisted Teaching.
2. Class Room Discussions, Brainstorming Sessions, Debates.
3. Activity: Organizing/Participation in Social Service Programs.
4. On Ground: Drill training.

CIE: 100 Marks

1. CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
2. CIE 2 for 60 marks – A practical test conducted at the end of the semester.

Textbooks:

1. NCC Cadets Handbook –Common Directorate General of NCC, New Delhi.
2. NCC Cadets Handbook –Special(A), Directorate General of NCC, New Delhi.

References:

1. Chandra B. Khanduri, "Field Marshal KM Cariappa: a biographical sketch", Dev Publications,2000.
2. Gautam Sharma, "Valour and Sacrifice: Famous Regiments of the Indian Army", Allied Publishers,1990.

Department of Humanities and Social Sciences
Choice Based Credit System (CBCS)
SEMESTER – III

English Communications Skill I (0:0:0:0) 0
(Common to all Branches, for Lateral Entry Diploma students)
(Effective from the academic year 2025-2026)

Course Code	BENGDIP1	CIE Marks	100
Teaching Hours/Week (L: T:P:S)	0:0:0:0 - NCMC	SEE Marks	-
Total Number of Lecture Hours	26 (Practical)	Total Marks	100

Course objectives:

This course will enable students to

1. Familiarize with basic English Grammar and Communication Skills in general.
2. Identify the nuances of phonetics, intonation and enhance pronunciation skills
3. Enhance English vocabulary and language proficiency for better communication skills.
4. Learn about Techniques of Information Transfer through presentation

Module – 1: Fundamentals of Communication

Introduction, Communication-an overview, Definition of communication, Features of successful professional communication, Importance of communication, Purpose of professional communication, Rule of critical and creative thinking in effective communication, Role of emotions in communication, Role of Inter-Cultural Communication, Different forms of communication, Communication network in an organization, Barriers to communication, Some remedies.

Non-verbal communication: Introduction, Body language, Paralinguistic features, Proxemics/ Space distance, Haptics. **4 Hours**

Module – 2: Grammar Essentials and Phonetics

Grammar: Essentials and Applications

Introduction, Parts of Speech, Articles and Prepositions, Modals, Sentences and their types, Subject- verb, Concord, using tenses, Moods of Verbs, Active passive voice, Direct indirect speech, Clause and its types, Using non-Finites.

Basic of Phonetics: Introduction, Reasons for incorrect pronunciations, received pronunciation, Misconceptions about sounds, Transcriptions, Problems of Indian English, Syllables, Word stress, How to transcribe, Weak forms, Intonation and rhythm, Difference between British American and

Indian spoken English**.** **6 Hours**

Module – 3: Reading and Listening Skills

Reading skills: Introduction, need for developing efficient reading skills, Benefits of effective reading, Speed of reading, four basic steps to effective reading, overcoming common obstacles, Types, Approaches to efficient reading, Tips for effective reading, employing different reading skills, Understanding the authors point of view, Identifying the central idea, inferring lexical and contextual meaning, employing discourse analysis, Worked out passages.

Listening skills: Introduction, Listening is an art, Listening vs hearing, Poor vs effective listening, Advantages of good listening, Process of listening, Types of listening. Intensive listening vs extensive listening, Barriers to effective listening, five steps of active listening techniques for effective listening, Listening and not taking. **8 Hours**

Module – 4: Paragraphs and Precis Writing
Introduction, precise, Summary, Abstract, Synopsis, Paraphrasing, Art of condensation, Some working principles, Seven step ladder to writing an effective precis, Writing precise for given passages, Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Descriptive writing techniques, Augmentative paragraph, Analytical paragraph. **4 Hours**
Module – 5: Professional Presentations and Writing
Professional Presentations: Introduction, combating stage fright, preparing PPT slides, Describing objects, Situations and people, Individual and group presentations, Delivering JAMs **Essays, Letters, Resumes:** Introduction, Types of essays, Characteristic features of an essay, Stages in essay writing, Components comprising an essay, Essay writing-guiding principles, Business letters and resumes- Importance, Elements of structure, Layout. Business letters- Elements of style, Types of business letters, Resume preparation. **4 Hours**
Course Outcomes: The students will be able to: 1. Understand and apply basic English grammar for effective communication. 2. Identify the nuances of phonetics, intonation, and enhance pronunciation skills. 3. Understand and use all types of English vocabulary and language proficiency. 4. Enhance their knowledge about techniques of information transfer through presentations.
Textbooks 1. Meenakshi Raman and Sangeeta Sharma, Technical Communication Principles and Practice, Oxford Publications, 3rd Edition, 2015 2. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University Press,2015 3. A Textbook of English Language Communication Skills, (ISBN-978-81-955465-2-7), Published by Infinite Learning Solutions, Bengaluru - 2022. **References** 1. Gajendra Singh Chauhan, Technical Communication Cengage Learning India Pvt Limited, Latest Revised Edition, 2019 2. Michael Swan, Practical English Usage, Oxford University Press, 2016 **3.** N.P.Sudharshana and C.Savitha, English for Engineers, Cambridge University Press, 2018