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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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

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

Estd : 1986

III Semester
Scheme & Syllabus of B.E. Programme
Computer Science & Design
(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTEOF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

AICTE Approved, Accredited by NBA(CSE, ISE, ECE, ME, CV, AE) and NAAC with 'A+' grade, QS – I Gauge Gold Rated

SCHEME OF TEACHING AND EXAMINATION – B.E. – CSD

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

3rd Semester

Branch Name- COMPUTER SCIENCE AND DESIGN

Sl. No.	Course Code	Course Title	Course Type	TD/ PSB	Teaching Hours / Week			Examination				
					L	T	P	SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	Credits
1	BMATS301	Probability & Statistics	ASC	MAT	3	2	0	3	50	50	100	4
2	BCS302	Digital Design and Computer Organization	IPCC	CSD	3	0	2	3	50	50	100	4
3	BCS303	Operating Systems	IPCC	CSD	3	0	2	3	50	50	100	4
4	BCS304	Data Structures and Applications	PCC	CSD	3	0	0	3	50	50	100	3
5	BCSL305	Data Structures Lab	PCCL	CSD	0	0	2	3	50	50	100	1
6	BCS306x	ESC/ETC/PLC	ESC	CSD	If the course is a Theory: 3	0	0	3	50	50	100	3
					If the course is a Laboratory: 2	0	2					
7	BSC307	Social Connect and Responsibility	SCR	ANY DEPT	0	0	2	-	100	-	100	1
8	Bxx308x	Ability Enhancement Course/Skill Enhancement Course – III	AEC/ SEC	CSD	If the course is a Theory: 1	0	0	1	50	50	100	1
					If the course is a Laboratory: 0	0	2	2				

9	BES309	Environmental Studies	MC	Civil	1	0	0	**1**	**50**	**50**	**100**	**1**
10	BNS310	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	**-**	**100**	**-**	**100**	**0**
	BPE310	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO310	Yoga		Yoga Teacher								
	BMU310	Music		Music Teacher								
11	BCE311	Competency Enhancement Course-1	NCMC	CDCAC	2	0	0	**-**	**100**	**-**	**100**	**0**
									700	**400**	**1100**	**22**

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

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

Course Code	Course Name	Course Code	Course Name
BCS306A	Numerical Techniques	BCS306C	Web Application Development with HTML and PHP
BCS306B	Object Oriented Programming with C++	BCS306D	Unix & Shell Programming

Ability Enhancement Course/Skill Enhancement Course – III

Course Code	Course Name	Course Code	Course Name
BCS308A	Data Analytics with Tableau and Power BI	BCS308C	Project Management with Git
BCS308B	Data Analytics with R	BCS308D	Data Visualization with Python

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

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

Semester: III					
Probability and Statistics					
Course Code	:	BMATS301	**Credits**	:	4
Hours/Week (L:T:P)	:	3:2:0	**CIE**	:	50 Marks
Total Hours	:	50L	**SEE**	:	50 Marks
Course Type	:	ASC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Basic Mathematics.
Knowledge on Fundamental Concepts	Basic Differentiation and Integration.
Knowledge on Connected Tools (If any)	Basic Computer Knowledge.

Course Learning Objectives: This course will enable the students to	
CLO1	Find the association between attributes and the correlation between two variables.
CLO2	Introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Engineering and social life situations.
CLO3	Provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
CLO4	Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.
CLO5	Find the association between attributes and the correlation between two variables.

Module- 1	**10 Hrs**
Curve fitting and Statistical Analysis: Curve fitting by method of least squares: y = ax+b, y = ax^2 +bx+c and y= ab^x , Correlation–Karl Pearson's coefficient of correlation, Rank correlation and Regression analysis – lines of regression (without proof)- problems. **Self-study:** Curve fitting by method of least squares: y= ae^{bx}, ax^b. **Applications:** Multiple regression in performance tuning and optimization in software engineering. **Text Book 1: Ch 24: 24.5(a), 24.5(b), 24.6(1), Ch 25: 25.12, 25.13, 25.16, 25.14** **Text Book 2: Ch 11: 11.1-11.3, Ch 12**	
Module- 2	**10 Hrs**
Probability Distributions-1: Random Variables (Discrete and Continuous), Probability mass and density functions, Mathematical expectation, Mean and variance, Discrete probability distributions: Binomial, Poisson, and Normal distributions (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. **Self-study:** Exponential distribution. **Applications:** Analyse the performance of the algorithms. **Text Book 1: Ch 4: 4.1-7.4.1, Ch 5: 5.1-5.4**	
Module- 3	**10 Hrs**
Probability Distributions-2: Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient, Stochastic process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains,	

higher transition probability-simple problems.
Self-study: Joint Probability distribution for two continuous random variables.
Applications: Rank web pages based on their importance.

Text Book 2: Ch 3: 3.1-3.4, Ch 5: 5.2-5.5

Module- 4	**10 Hrs**

Sampling Theory: Introduction, sampling distribution, standard error, Type-I and Type-II errors. Testing of hypothesis, levels of significance, confidence limits, test of significance for large samples for mean and proportions, test of significance for small samples – Students 't' distribution, Chi-square distribution as a test of goodness of fit.
Self-study: sampling of attributes, F-distribution.
Applications: Data analysis and Cryptography.

Text Book 2: Ch 1: 1.1-1.2, Ch 6: 6.7, Ch 8: 8.1-8.6, Ch 10: 10.1-10.8

Module- 5	**10 Hrs**

Design of Experiments & ANOVA:
Principles of experimentation in design, The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA, Latin-square Design.
Self-study: Analysis of completely randomized design, randomized block design.
Applications: Comparison of algorithm performance.

Text Book 3: Ch 1-Ch 5

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze data using correlation and regression techniques. And Apply the principles of least squares to perform curve fitting.
CO2	Utilize probability distributions and random variable concepts to model and simulate uncertainties in engineering systems such as atmospheric turbulence.
CO3	Apply the notion of a discrete-time Markov chain and n-step transition probabilities to solve the given problem.
CO4	Apply statistical inference techniques including hypothesis testing, error analysis.
CO5	Develop the knowledge of experimental design and perform statistical analysis using ANOVA techniques.

Text Books	
1	A First Course in Probability, Sheldon Ross, 10th Edition, 2019, ISBN-13: 978-0134753119.
2	Probability and Statistics for Engineers and Scientists, Ronald E. Walpole et al., 9th Edition, 2010, ISBN-13: 978-0321629111.
3	Design and Analysis of Experiments, Douglas C. Montgomery's, 9th Edition, 2012, ISBN-13: 978-1118146927.

Reference Books	
1	Calculus, James Stewart: Cengage Publications, 7th Edition, 2019 ISBN-10: 9780538497909.
2	Engineering Mathematics, Srimanta Pal & Subodh C.Bhunia: Oxford University Press, 3rd Edition, 2016.

3	A Textbook of Engineering Mathematics, N.P Bali and Manish Goyal: Laxmi Publications, 10th Edition, 2022.
4	Advanced Engineering Mathematics, C. Ray Wylie, Louis C. Barrett: McGraw – Hill Book Co., New York, 6th Edition, 2017, ISBN-13: 978-0071135436.
5	Higher Engineering Mathematics, H.K. Dass and Er. Rajnish Verma: S.Chand, 3rd Edition, Publication, 2014, ISBN-10: 8121938902.

Web links and Video Lectures (e – Resources)	
1	http://nptel.ac.in/courses.php?disciplineID=111
2	http://www.class-central.com/subject/math(MOOCs)

CO – PO MAPPING

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

Semester: III					
Digital Design & Computer Organization					
Course Code	:	BCS302	**Credits**	:	4
Hours/Week(L:T:P)	:	3:0:2	**CIE**	:	50 Marks
Total Hours	:	40L+12P	**SEE**	:	50 Marks
Course Type	:	IPCC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Basic knowledge of electronics.
Knowledge on Fundamental Concepts	Understanding of number systems, Boolean algebra, logic gates, combinational and sequential circuits, data representation.
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Demonstrate the functionalities of binary logic system.
CLO2	Explain the working of combinational and sequential logic system.
CLO3	Realize the basic structure of computer system.
CLO4	Illustrate the working of I/O operations and processing unit.
CLO5	Implement efficient arithmetic operations.

Module – 1	**08 Hrs**
Introduction to Digital Design: Binary Logic, Basic Theorems And Properties Of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit. **Text Book 1: Ch 1:1.9, Ch 2: 2.4, 2.5, 2.8, Ch 3: 3.1, 3.3, 3.5, 3.6, 3.9**	
Module – 2	**08 Hrs**
Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder-Subtract or, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. **Sequential Logic:** Introduction, Sequential Circuits, Storage Elements - Latches, Flip-Flops. **Text Book 1: Ch 4: 4.1, 4.2, 4.4, 4.5, 4.9-4.12, Ch 5: 5.1-5.4**	
Module – 3	**08 Hrs**
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: Ch 1: 1.2-1.4, 1.6, Ch 2: 2.2, 2.3-2.5**	

Module – 4	08 Hrs
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: Ch 4: 4.1, 4.2.1-4.2.3, 4.4, Ch 5: 5.4, 5.5.1**	
Module – 5	**08 Hrs**
Arithmetic: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed – operand multiplication, Fast multiplication. **Text Book 2: Ch 6: 6.1-6.5**	

Practical Component of IPCC

Sl. No.	Experiments Simulation packages preferred: Multisim, Modelsim, PSpice or any other relevant
1	Given a 4-variable logic expression, simplify it using appropriate technique and implement the same using basic gates.
2	Implement Binary– Half and Full Adder, Half and Full Subtractor using basic gates.
3	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
4	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5	Design Verilog HDL to implement Decimal adder.
6	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
7	Design Verilog program to implement types of De-Multiplexer.
8	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the fundamental concepts of digital design, computer organization components.
CO2	Demonstrate the working principles and basic theorems of digital design and the purpose of memory and I/O organization in digital systems.
CO3	Apply Boolean algebra and K-map techniques to simplify logic expressions, for the construction of combinational circuits.
CO4	Analyze the structure and performance of digital systems to determine their operational effectiveness.
CO5	Evaluate, compare and recommend optimized solutions in various applications of digital design and computer operations.

Text Books	
1	Digital Design With an Introduction to Verilog Design, M. Morris Mano & amp, Michael D. Ciletti, 5th Edition, 2013, Pearson Education, ISBN-10: 8131794741.

2	Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, 2019, Tata McGraw Hill, ISBN-13: 9781259005275.

Reference Books	
1	Digital Design and Computer Architecture, David Money Harris and Sarah L. Harris, 1st Edition, 2007, Elsevier, ISBN: 9780080922812.
2	Computer Organization and Architecture, William Stallings, 11th Edition, 2022, Pearson Education, ISBN-10: 9356061599.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=g3oSkhK9ghg&list=PLDVWzw0WSIX6sIZo1WiVFooEFOV3d0LNx
2	https://www.youtube.com/watch?v=CDO28Esqmcg&list=PLhwVAYxlh5dvB1MkZrcRZy6x_a2yORNAu

CO – PO MAPPING

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

Semester: III					
Operating Systems					
Course Code	**:**	BCS303	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40L+14P	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through Programming.
Knowledge on Fundamental Concepts	Basic programming, Data structures, Mathematical logic and set theory, Computer Organization and Architecture.
Knowledge on Connected Tools (If any)	CLI, Basic Shell Commands, Text Editors, File System Tools, User and Permission Tools.

Course Learning Objectives: This course will enable the students to	
CLO1	Gain an understanding of why an operating system is essential and recognize the various types of operating systems.
CLO2	Learn how system resources like CPU, memory, and storage are managed efficiently.
CLO3	Explain and apply system-level APIs for managing processor, memory, and storage resources.
CLO4	Use system-level commands to configure and maintain file systems and related storage operations.
CLO5	Understand the need for protecting information and how operating systems implement security mechanisms.

Module – 1	**08 Hrs**
Introduction to operating systems, System structures: What operating systems do, Computer System organization, Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and Security, Distributed system, Special-purpose systems, and Computing environments. **Operating System Services:** User - Operating System interface, System calls, Types of system calls, System programs, Operating system design and implementation, Operating System structure, Virtual machines, Operating System debugging, Operating System generation, System boot. **Text Book 1: Ch 1: 1.1-1.12, Ch 2: 2.2-2.11**	
Module – 2	**08 Hrs**
Process Management: Process concept, Process scheduling, Operations on processes, Inter process communication. **Multi-threaded Programming:** Overview, Multithreading models, POSIX Thread, Threading issues. **Process Scheduling**: Basic concepts, Scheduling Criteria, Scheduling Algorithms, Thread scheduling Multiple-processor scheduling.	

Text Book 1: Ch 3: 3.1-3.4, Ch 4: 4.1-4.4, Ch 5: 5.1-5.5
Text Book 2: Ch 2: 2.2.3

Module – 3	**08 Hrs**

Process Synchronization: Synchronization: The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization.
Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Text Book 1: Ch 6: 6.1-6.6, Ch 7: 7.1-7.7

Module – 4	**08 Hrs**

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

Text Book 1: Ch 8: 8.1-8.6, Ch 9: 9.1-9.6

Module – 5	**08 Hrs**

File Systems: File system: Files, Directories.
Implementing File system: File system structure, File system implementation, Directory implementation, Allocation methods, Free space management.
Secondary Storage Structure, Protection: Mass storage structures, Disk structure, Disk attachment, Disk scheduling, Disk management.
Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix and its Implementation.

Text Book 1: Ch 11: 11.1-11.5, Ch 12: 12.1-12.5, Ch 17: 17.1-17.5
Text Book 2: Ch 4: 4.1-4.2

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1	Implementation of basic UNIX commands using file APIs- Write a program to implement commands ls (-l option), cp, rm and mv using UNIX file APIs.
2	Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process).
3	Simulate the following CPU scheduling algorithms to find turnaround time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.
4	Develop a C program to simulate producer-consumer problem using semaphores/Mutex.
5	Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
6	Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.
7	Develop a C program to simulate the following contiguous memory allocation Techniques: a) Worst fit b) Best fit c) First fit.
8	Develop a C program to simulate page replacement algorithms:

	a) FIFO b) LRU
9	Develop a C program to simulate the Linked file allocation strategies.
10	Develop a C program to simulate SCAN disk scheduling algorithm.
11	Apply the pthread library to build Applications to demonstrate use of pthread library functions to create and manage threads.

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer the structure and functionality of operating system.
CO2	Apply appropriate CPU scheduling algorithms for the given problem.
CO3	Analyze the various techniques for process synchronization and deadlock handling.
CO4	Apply the various techniques for memory management.
CO5	Inspect file, secondary storage management strategies and information protection mechanisms.

Text Books	
1	Operating System Principles, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th Edition, 2015, Wiley-India, ISBN: 978-81-265-0962-1.
2	Modern Operating Systems, Tanenbaum, Andrew, 4th Edition, 2009, Pearson Education, ISBN: 978-0133591620.

Reference Books	
1	Operating Systems: A Modern Perspective, Gary J. Nutt, 1st Edition, 20 Aug 2009, Addison Wesley, The University of Virginia, ISBN: 0201741962.
2	Understanding Operating System, Ann McHoes Ida M Fylnn, 6th Edition, 2013, Cengage Learning, ISBN: 9788131521564.
3	Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, 2013, McGraw- Hill, 2013, ISBN: 978-1259005589.
4	An Introduction to Operating Systems: Concepts and Practice, P.C.P. Bhatt, 4th Edition, 2014, PHI(EEE), ISBN: 9789387472877.
5	William Stallings Operating Systems: Internals and Design Principles, 6th Edition, 2011, Pearson, ISBN: 978-0273751502.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106106144
2	https://youtu.be/mXw9ruZaxzQ
3	https://archive.nptel.ac.in/courses/106/105/106105214/
4	https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO
5	https://github.com/nthnluu/weenix - writing parts of a Unix kernel.
6	https://github.com/cfenollosa/os-tutorial - How to create an OS from scratch

CO – PO MAPPING

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

Semester: III					
Data Structures and Applications					
Course Code	**:**	BCS304	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through C Programming.
Knowledge on Fundamental Concepts	Programming skills.
Knowledge on Connected Tools (If any)	Text Editor.

Course Learning Objectives: This course will enable the students to	
CLO1	Gain the knowledge of the fundamentals of data structures and their applications.
CLO2	Illustrate representation of Different data structures such as Stack, Queues, Linked Lists, Trees and Graphs.
CLO3	Use linear data structures to design and develop solutions to real world problems.
CLO4	Discuss applications of Nonlinear Data Structures in problem solving.
CLO5	Apply the hashing techniques in mapping key value pairs and Optimal Binary Search Trees.

Module - 1	**08 Hrs**
Introduction to Data Structures: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Review of pointers and dynamic Memory Allocation. **Arrays and Structures:** Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Strings. **Textbook 1: 1.1 - 1.4** **Textbook 2: Ch.1:1.2, Ch.2: 2.1 - 2.5(2.5.1-2.5.3), 2.7(2.7.1,2,7.2)**	
Module - 2	**08 Hrs**
Stacks: Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions, Recursion, Tower of Hanoi. **Queues:** Queues, Circular Queues Using Dynamic Arrays, Multiple Stacks and queues. **Textbook 2: Ch.3: 3.1-3.4,3.6,3.7** **Textbook 1: Ch.6: 6.7,6.8**	
Module - 3	**08 Hrs**
Linked Lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List Operations, Sparse Matrices, Doubly Linked Lists. **Textbook 2: Ch.4: 4.1 - 4.5, 4.7, 4.8**	

Module - 4	08 Hrs
Trees: Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Binary Search trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees. **Textbook 2: Ch.5: 5.1 - 5.3, 5.5, 5.7 - 5.11**	
Module - 5	**08 Hrs**
Graphs: The Graph Abstract Data Type, Elementary Graph Operations. **Hashing:** Introduction, Static Hashing, Dynamic Hashing. **Introduction to Efficient Binary Search Trees:** Optimal Binary Search Trees. **Textbook 2: Ch.6: 6.1, 6.2, Ch.8: 8.1 - 8.3, Ch.10: 10.1**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer the concept of linear and nonlinear data structures.
CO2	Apply array, stack and queue concepts to solve problems.
CO3	Illustrate various the concept of linked list concepts to solve real world problems.
CO4	Analyse Tree Data Structure to develop solutions for real-world problems.
CO5	Apply graph traversal techniques to search and hashing techniques to organize the data.

Text Book	
1	"Data Structures Schaum's Outlines", Seymour Lipschutz, 1st Ed, McGraw Hill, 2014, ISBN 978-1259029967
	"Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, 2nd Ed, Universities Press, 2023, ISBN:978 81 7371 605 8

Reference Books	
1	"Data Structures using C", Reema Thareja, 3rd Ed, Oxford press, 2023, ISBN 978-9354977190
2	"A Pseudo-code approach with C", Gilberg & Forouzan, 2nd Ed, Cengage Learning,2014, ISBN 978-8131503140
3	"An Introduction to Data Structures with Applications", Jean-Paul Tremblay & Paul G. Sorenson, 2nd Ed, McGraw Hill, 2017 ISBN 978-0074624715

Web links and Video Lectures (e – Resources)	
1	http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2	https://nptel.ac.in/courses/106/105/106105171/
3	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
4	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
5	https://nptel.ac.in/courses/106/102/106102064/

CO – PO MAPPING

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

Semester: III					
Data Structures Lab					
Course Code	:	BCSL305	**Credits**	:	1
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	50 Marks
Total Hours	:	15P	**SEE**	:	50 Marks
Course Type	:	PCCL	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Problem Solving through C Programming.
Knowledge on Fundamental Concepts	C Programming concepts.
Knowledge on Connected Tools (If any)	Text Editor.

Course Level Objectives: This course will enable the Students to	
CLO1	Gain the knowledge of dynamic memory management concepts in C.
CLO2	Illustrate various Linear data structures and their applications such as stacks, queues and lists.
CLO3	Illustrate various Non-Linear data structures and their applications such as trees and graphs.
CLO4	Develop problem-solving skills by applying appropriate data structures.
CLO5	Integrate file handling techniques with data structures.

Practical Component:

Sl. No.	**Experiments**
1	Develop a Program in C for the following: a. Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b. Write functions create(), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.
2	Develop a Program in C for the following operations on Strings. a. Read a main String (STR), a. Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.

3	Develop 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 how Stack can be used to check Palindrome. d. Demonstrate Overflow and Underflow situations on Stack. e. Display the status of Stack. f. Exit. Support the program with appropriate functions for each of the above operations.
4	Develop 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.
5	Develop a Program in C for the following Stack Applications. a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks.
6	A food delivery app handles customer orders as they arrive. The orders must be processed in the order they were received, making queue data structure ideal. Design and implement a C program to simulate this system using a Circular queue. Program should have options to add and remove the food orders in appropriate order for their service. (Array Implementation of Queue with maximum size MAX). Include C functions to perform the following operations. a. Add a new food order. b. Delete an older order. c. Display all current orders in queue. d. Demonstrate Overflow and Underflow conditions.
7	A student To-Do Task Manager app allows the students to manage academic Task with member's id, title, dueDate, Category, priority. The facilities to be provided for the users are as follows: a. Create a Tasks. b. Add Task to start/end. c. Delete Task from start/end. d. View first/last task. e. Handle empty list conditions Design and Implement a menu driven Program in C for the above operations using Singly Linked List.
8	Develop 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, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes. 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.

9	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = $6x^2y^2z-4yz^5+3x^3yz+2xy^5z-2xyz^3$ b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations.
10	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.
11	Develop 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 DFS/BFS method.
12	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. 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.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze various linear and non-linear data structures.
CO2	Demonstrate the working of different types of data structures.
CO3	Apply appropriate searching and sorting algorithms for the given scenario.
CO4	Apply the appropriate data structure for solving real world problems.
CO5	Design and formulate various methods of organizing data.

Web links and Video Lectures (e – Resources)	
1	http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
2	https://nptel.ac.in/courses/106/105/106105171/
3	http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
4	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
5	https://nptel.ac.in/courses/106/102/106102064/

CO – PO MAPPING

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

Semester: III					
Numerical Techniques					
Course Code	:	BCS306A	**Credits**	:	3
Hours/Week(L:T:P)	:	3:0:0	**CIE**	:	50 Marks
Total Hours	:	40L	**SEE**	:	50 Marks
Course Type	:	ESC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Calculus, Linear Algebra, Differential Equations.
Knowledge on Fundamental Concepts	Numerical methods for solving equations, interpolation, numerical integration and error analysis.
Knowledge on Connected Tools (If any)	MATLAB, GNU Octave.

Course Learning Objectives: This course will enable the students to	
CLO1	Describe the concepts and methods of numerical differentiation and integration including adaptive and Gaussian techniques.
CLO2	Implement various numerical methods for solving ordinary differential equations including Runge-Kutta and predictor-corrector techniques.
CLO3	Apply finite difference and iterative techniques for solving partial differential equations numerically.
CLO4	Solve systems of linear algebraic equations using direct and iterative numerical methods.
CLO5	Construct solutions for engineering problems using the finite element method, Rayleigh-Ritz and Galerkin approaches.

Module – 1	**08 Hrs**
Numerical Differentiation and Integration Introduction, Numerical Differentiation, Numerical Integration, Euler-Maclaurin Formula, Adaptive Quadrature Methods, Gaussian Integration, Singular Integrals, Fourier Integrals, Numerical Double Integration. **Applications:** Link of Robotic Arm using MATLAB. **Self-study:** Multiple Integrals. **Text Book 1: Ch 11, Ch 12: 12.2-12.5, 12.8** **Text Book 2: Ch 5: 5.2, 5.4-5.7, 5.9, 5.10**	
Module – 2	**08 Hrs**
Numerical Solution of Ordinary Differential Equations Introduction, Solution by Taylor's Picard's Method, Euler's Method, Runge-Kutta Methods, Predictor-Corrector Methods, the Cubic Spline Method, Simultaneous and Higher Order Equations, Boundary Value Problems: The Shooting Method, Finite-Difference Method. **Applications:** Phase-Locked Loop using MATLAB. **Self-study:** Error estimation for the Euler method. **Text Book 1: Ch 13: 13.2, 13.3, 13.6, 13.11, Ch 14: 14.2, 14.3** **Text Book 2: Ch 7: 7.1-7.8, 7.10**	

Module – 3	**08 Hrs**
Numerical Solution of Partial Differential Equations Introduction, Finite-Difference Approximations, Laplace's Equation: Jacobi's Method, Gauss-Seidel Method, SOR Method, ADI Method, Parabolic Equations, Iterative Methods, Hyperbolic Equations. **Applications:** Plate Deflection using MATLAB. **Self-study:** Laplace equation. **Text Book 1: Ch 15: 15.2-15.5** **Text Book 2: Ch 8: 8.1-8.3, 8.3.1-8.3.4, 8.4-8.6**	
Module – 4	**08 Hrs**
System of Linear Algebraic Equations Introduction, Solution of Centro-symmetric Equations, Direct Methods, LU- Decomposition Methods, Iterative Methods, ILL-conditioned Linear Systems. **Applications:** Singular value decomposition. **Self-study:** Consistency of linear system of equations. **Text Book 2: Ch 6: 6.1, 6.3, 6.3.6, 6.3.10, 6.3.11**	
Module – 5	**08 Hrs**
The Finite Element Method: Functionals- Base Function Methods of Approximation- The Rayleigh - Ritz Method -The Galerkin Method, Application to two dimensional problems Finite element Method for one- and two-dimensional problems. **Applications:** Application to two dimensional problems. **Self-study:** Finite element method for two dimensional. **Text Book 2: Ch 10: 10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.3, 10.4.1, 10.4.2**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the principles of numerical integration, including singular and Fourier integrals and their practical applications.
CO2	Demonstrate the use of ODE solvers such as Euler's, Taylor's, and spline methods to compute approximate solutions.
CO3	Utilize numerical methods like Jacobi, Gauss-Seidel, SOR, and ADI to solve PDEs in different forms.
CO4	Analyze and compare the accuracy and stability of LU-decomposition and iterative methods in solving linear systems.
CO5	Develop approximate solutions for 1D and 2D boundary value problems using Finite Element Methods.

Text Books	
1	Numerical Methods, Balagurusamy, Standard Edition, 1st Edition, July 2017, Tata McGraw –Hill, ISBN: 978-0074633113.
2	Introductory Methods of Numerical Analysis, S.S. Sastry, 4th Edition, February 2005, Prentice Hall of India Private Limited, ISBN: 81-203-2761-6.

Reference Books	
1	Numerical Analysis and Algorithms, Niyogi, Pradip, 1st Edition, 2003, Tata McGraw – Hill, ISBN: 9780070494930.
2	Applied Numerical Methods for Engineers using MATLAB and C, Robert j, Schilling and Sandra L. Harris., 1st Edition, 2002, Thomson Asia Pte Ltd., ISBN: 981-240-602-6.
3	Numerical Analysis, Ranganatham, Prasad, Ramesh Babu, 4th Edition, 2016, S. Chand & Company PVT.LTD, ISBN: 978-525-3345-9.

CO – PO MAPPING

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

Semester: III					
Object Oriented Programming with C++					
Course Code	**:**	BCS306B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	2:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	30L+10P	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving through C Programming.
Knowledge on Fundamental Concepts	Basic understanding of programming logic, datatypes, Control structures, operators and functions.
Knowledge on Connected Tools (If any)	Visual Studio Code, Code Blocks.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basics of object-oriented programming in C++ for organizing and storing related data using objects.
CLO2	Implement constructors in C++ which are special type of functions.
CLO3	Demonstrate how a class can depend on another class to achieve modular and reusable code.
CLO4	Analyze the use of virtual functions and explain their role in enabling runtime polymorphism.
CLO5	Apply exception handling techniques and use file I/O operations to process data.

Module – 1	**06 Hrs**
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. **Text Book : Ch 11, Ch 12**	
Module – 2	**06 Hrs**
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. **Text Book: Ch 13, Ch 14**	
Module – 3	**06 Hrs**
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. **Text Book : Ch 15, Ch 16**
Module – 4 **06 Hrs**
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. **Text Book: Ch:17, Ch:18**
Module – 5 **06 Hrs**
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: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF. **Text Book: Ch 19, Ch 20, Ch 21**

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the fundamental principles of Object-Oriented Programming and demonstrate the use of C++ classes, objects.
CO2	Demonstrate the use of constructor overloading to provide multiple ways of initializing objects.
CO3	Develop efficient, reusable, and well-structured object-oriented solutions by applying inheritance principles.
CO4	Implement compile-time and run-time polymorphism to solve the given problem.
CO5	Analyze the interaction between exception handling and file I/O in building reliable C++ programs.

Text Book	
1	The Complete Reference C++, Herbert Schildt, 4th Edition, 2005, McGraw-Hill Education, ISBN: 0072226803.

Reference Books	
1	Object Oriented Programming with C++, A K Sharma, 1st Edition, 2014, Pearson Education, ISBN-13: 9789332535804.
2	Object Oriented Programming with C++, M.P. Bhave, 1st Edition, 2004, Pearson Education, ISBN-13: 9788177583077.

Web links and Video Lectures (e – Resources)	
1	Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2	https://www.w3schools.com/cpp/cpp_intro.asp 2

3	https://www.edx.org/course/introduction-to-c-3
4	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843642506788864433 75_shared/overview
5	https://onlinecourses.nptel.ac.in/noc20_cs07/preview

Practical Component

Note: Design, Develop and Implement the following problem statements using C++

Sl. No.	Experiments
1	To find the largest of three numbers.
2	To sort the elements in ascending and descending order.
3	Using classes to display student name, roll number, marks obtained in two subjects and total score of students.
4	For a bank employee to print name of the employee, account_no. & balance. Print invalid balance if amount<500, Display the same, also display the balance after withdraw and deposit.
5	To demonstrate function overloading for the following prototypes. add(int a, int b), add(double a, double b).
6	Using Operator Overloading for overloading Unary minus operator.
7	Using Multiple inheritance for performing arithmetic operation of two numbers.
8	Using Constructor in Derived classes to initialize alpha, beta and gamma and display corresponding values.
9	Virtual functions to implement polymorphism.
10	a. To perform simple calculator operation using class template. b. To implement stack and its operations using template class.
11	A function which throws a division by zero exception and catch it in catch block.
12	To handle array out of bound exception.

CO – PO MAPPING

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

Semester: III					
Web Application Development with HTML and PHP					
Course Code	**:**	BCS306C	**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	2:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	30L+10P	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem Solving using C Programming.
Knowledge on Fundamental Concepts	Computer Basics, Basic Logic Building, Text Editing Tools, Web and Internet Basics.
Knowledge on Connected Tools(If any)	Notepad++.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand web programming fundamentals, HTTP, security, and HTML structure.
CLO2	Describe the syntax, structure, elements, and how HTML and XHTML are different.
CLO3	Use CSS to style, arrange, and structure web pages.
CLO4	Explore the role of JavaScript and the DOM in changing how a page looks and behaves.
CLO5	Build server-side programs using PHP along with web server tools.

Module – 1	**06 Hrs**
Introduction to WEB Programming: Internet, WWW, Web Browsers, and Web Servers, URLs, MIME, HTTP, Security. Introduction to HTML, what is HTML and Where did it come from? HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements. **Text Book 1: Ch 1: 1.1-1.8**	
Module – 2	**06 Hrs**
HTML and XHTML: Origins of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text Markup, Images, Hypertext Links, Lists, and Tables. Forms, Syntactic differences between HTML and XHTML. **Text Book 1: Ch 2: 2.1-2.10**	
Module – 3	**06 Hrs**
CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box Model, Background images, tags. **Text Book 1: Ch 3: 3.1 - 3.12**	

Module - 4	06 Hrs
JavaScript: What is JavaScript and What can it do? JavaScript Design Principles, Where does JavaScript Go?, Syntax, JavaScript Objects, The Document Object Model (DOM),JavaScript Events. **Text Book 2: Ch 6: 6.1 - 6.7**	
Module - 5	**06 Hrs**
Introduction to Server-Side Development with PHP: What is Server-Side Development, A Web Server's Responsibilities, Quick Tour of PHP, Program Control, Functions, PHP Arrays and Superglobals: Arrays, $_GET and $_POST Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files. **Text Book 2: Ch 8: 8.1-8.5, Ch 9: 9.1-9.5**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the fundamentals of web programming concepts to build structured web pages.
CO2	Design interactive web pages using HTML and XHTML.
CO3	Develop responsive web pages using CSS.
CO4	Apply JavaScript for dynamic and interactive content.
CO5	Analyze server-side processes to design and optimize PHP applications.

Text Books	
1	Programming the World Wide Web, Robert W Sebesta, 6th Edition, 2008, Pearson Education, ISBN: 978-0-13-213081-3.
2	Fundamentals of Web Development, Randy Connolly, Ricardo Hoar, 1st Edition, 2016, Pearson Education, ISBN: 978-9332575271.

Reference Books	
1	Internet & World Wide Web How to program, M.Deitel, P.J.Deitel, A.B.Goldberg, 4th Edition, 2008, Pearson Education / PHI, ISBN 0-13-175242-1.
2	Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5, Robin Nixon, 4th Edition, 2015, O Reilly Publications, ISBN: 978-9352130153.
3	PHP and MySQL Web Development, Luke Welling, Laura Thomson, 5th Edition, 2016, Pearson Education, ISBN: 978-9332582736.
4	Professional JavaScript for Web Developers, Nicholas C Zakas, 3rd Edition, 2012, Wrox/Wiley India, ISBN: 978-8126535088.

Web links and Video Lectures (e – Resources)	
1	Fundamentals of WEB Programming: https://www.youtube.com/watch?v=DR9dr6gxhDM
2	HTML and XHTML: https://www.youtube.com/watch?v=A1XlIDDXgwg
3	CSS:https://www.youtube.com/watch?v=J35jug1uHzE
4	Java Script and HTML Documents: https://www.youtube.com/watch?v=Gd0RBdFRvF0

5	Dynamic Documents with JavaScript: https://www.youtube.com/watch?v=HTFSIJALNKc

PRACTICAL COMPONENT:

Sl. No.	Experiments
1	Develop the HTML page named as "Myfirstwebpage.html". Add the following tags with relevant content. 1. Set the title of the page as "My First Web Page" 2. Within the body use the following tags: a. Moving text = "Basic HTML Tags" b. Different heading tags (h1 to h6) c. Paragraph d. Horizontal line e. Line Break f. Block Quote g. Pre tag h. Different Logical Style (<b>,<u>,<sub>,<sup>etc).
2	Develop the HTML page named as "Table.html" to display your class time table. a. Provide the title as Time Table with table header and table footer, row-span and col-span etc. b. Provide various colour options to the cells (Highlight the lab hours and elective hours with different colours.) c. Provide colour options for rows.
3	Develop an external style sheet named as "style.css" and provide different styles for h2, h3, hr, p, div, span, time, img&a tags. Apply different CSS selectors for tags and demonstrate the significance of each.
4	Develop HTML page named as "registration.html" having variety of HTML input elements with background colors, table for alignment & provide font colors& size using CSS styles.
5	Develop HTML page named as "newpaper.html" having variety of HTML semantic elements with background colors, text-colors& size for figure, table, aside, section, article, header, footer… etc.
6	Apply HTML, CSS and JavaScript to design a simple calculator to perform the following operations: sum, product, difference, remainder, quotient, power, square-root and square.
7	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
8	Write a PHP program to display a digital clock which displays the current time of the server.
9	Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
10	Develop a PHP program (with HTML/CSS) to sort the student records which are stored in the database using selection sort.

CO – PO MAPPING

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

Semester: III					
Unix and Shell Programming					
Course Code	**:**	BCS306D	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	ESC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Problem solving through C Programming.
Knowledge on Fundamental Concepts	Basic OS Concepts, Computer Architecture Basics, programming logic and constructs.
Knowledge on Connected Tools (If any)	Text editors Vi, Vim, nano, gedit.

Course Learning Objectives: This course will enable the students to	
CLO1	To help the students to understand effective use of Unix concepts, commands and terminology.
CLO2	Identify, access, and evaluate UNIX file system.
CLO3	Understand UNIX command syntax and semantics.
CLO4	Ability to read and understand specifications, scripts and programs.
CLO5	Analyse Facility with UNIX Process.

Module – 1	**08 Hrs**
Introduction of UNIX - Introduction, History, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput and bc. **Text Book 1: Ch 1: 1.1-1.4, Ch 2: 2.1**	
Module – 2	**08 Hrs**
UNIX File System- The file, what's in a filename? The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system. **Text Book 1: Ch 4**	
Module – 3	**08 Hrs**
Basic File Attributes - Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find. **Text Book 1: Ch 6**	
Module – 4	**08 Hrs**
Introduction to the Shell Scripting - Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and **||,** exit, if and case conditions, expr, sleep and wait, while, until, for, $, @, redirection, The here document, set, trap, Sample Validation and Data Entry Scripts**.** **Text Book 1: Ch 11, Ch 12, Ch 14**	

Module – 5	08 Hrs
Introduction to UNIX System process: Mechanism of process creation, Parent and child process, The ps command with its options, Executing a command at a specified point of time: at command, Executing a command periodically: cron command and the crontab file, Signals. **Text Book 1: Ch 9, Ch 19**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the basics of Unix concepts and commands.
CO2	Evaluate the UNIX file system.
CO3	Apply Changes in file system.
CO4	Develop shell scripts for automation.
CO5	Analyse Facility with UNIX system process.

Text Books	
1	Unix Concepts & Applications, Sumitabha Das, 4th Edition, 2017, Tata McGraw Hill, ISBN-13: 978-0070635463.

Reference Books	
1	Unix Shell Programming, Yashwant Kanetkar, 1ST Edition, 2003, BPB Publications, ISBN: 9788170297536.
2	Introduction to UNIX, M G Venkatesh Murthy, 1ST Edition, 2005, *Pearson,* ISBN: 978-8177587456.
3	Unix and Shell Programming, B.M. Harwani, 1st Edition, 2013 Oxford University Press, ISBN-13: 978-0198082163.

Web links and Video Lectures (e – Resources)	
1	https://www.geeksforgeeks.org/introduction-linux-shell-shell-scripting/
2	https://www.tutorialspoint.com/unix/
3	https://archive.nptel.ac.in/courses/117/106/117106113/

CO – PO MAPPING

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

Semester: III					
Social Connect & Responsibility					
Course Code	**:**	BSC307	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	15P	**SEE**	**:**	-
Course Type	**:**	SCR	**SEE Duration**	**:**	-

Course Objectives: This course will enable the students to	
CLO1	Understand and appreciate the importance of environmental sustainability, cultural heritage and traditional practices.
CLO2	Apply experiential learning through field visits, case studies and community interaction.
CLO3	Develop skills in documentation, reporting and creative presentation through photo blogs or documentaries.
CLO4	Demonstrate awareness of organic farming, waste management, water conservation and their implementation in campus or community settings.
CLO5	Recognize the significance of indigenous crafts, culinary traditions and their socio-cultural value.

Module 1	**03 Hrs**
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. **Text Book 1**	
Module 2	**03 Hrs**
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. **Text Book 2**	
Module 3	**03 Hrs**
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. **Text Book 3**	
Module 4	**03 Hrs**
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. **Text Book 4**	

Module 5	03 Hrs
Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking – objectives, visit, case study, report, outcomes. **Text Book 5**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate the significance of tree plantation, cultural heritage, organic farming, waste management, water conservation and traditional food practices.
CO2	Demonstrate the ability to plan and execute community-focused environmental and cultural activities.
CO3	Prepare and present photo blogs or documentaries to document and communicate findings.
CO4	Apply sustainable practices learned from field visits in campus or community projects
CO5	Appreciate and promote indigenous knowledge, crafts and culinary traditions as part of cultural preservation.

Text Books	
1	Environmental Studies, Erach Bharucha, University Grants Commission, New Delhi.
2	Cultural Heritage of India, Haridas Bhattacharyya, Volumes 1–6, The Ramakrishna Mission Institute of Culture, ISBN: 818733*2050*.
3	Organic Farming: Principles and Practices, P. Bhattacharyya & D. Chakraborty, Scientific Publishers, ISBN: 9789395700665.
4	Water Resource Engineering, Larry Mays, 2nd Edition, 2010, Wiley, ISBN-13: 978-0470460641.
5	Indian Food: A Historical Companion, K. T. Achaya, Oxford University Press, ISBN-13: 978-0195634488.

CO – PO MAPPING

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

Semester: III					
Data Analytics with Tableau and Power BI					
Course Code	:	BCS308A	**Credits**	:	1
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	50 Marks
Total Hours	:	15P	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	2 Hours0

Prerequisites:	
Courses	Mathematics, Problem Solving through Programming.
Knowledge on Fundamental Concepts	Data types and data formats (CSV, Excel, JSON, etc.), Basics of data pre-processing, Basic visual literacy, analytical thinking.
Knowledge on Connected Tools (If any)	Microsoft Excel / Google Sheets, Power BI, Tableau.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the Importance of data Visualization for business intelligence and decision making.
CLO2	Learn different approaches to understand the importance of visual perception.
CLO3	Learn different data visualization techniques and tools.
CLO4	Gain knowledge of effective data visuals to solve workplace problems.
CLO5	Analyze the results and write simple reports to explain your findings.

Sl. No.	**Experiments**
1	Getting Started - Tableau Workspace, Tableau terminologies, basic functionalities.
2	Connecting to Data Source – Connecting to Database, Different types of Tableau Joins.
3	Creating a View - formatting charts, adding filters, creating calculated fields and defining parameters.
4	Dashboard Design and Storytelling – Components of Dashboard, Understanding how to place worksheets in Containers, Action filters and its types.
5	Introducing Power BI –Components and the flow of work. Power BI Desktop Interface- The Report has five main areas.
6	Querying Data from CSV - Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.
7	Creating Reports & Visualizations - Different types of charts, Formatting charts with Title, Colors.
8	Dashboards - Filters in Power BI, Formatting dashboards.
9	Analysis of revenue in sales dataset: a. Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. b. Create a line chart to show the revenue based on the month of the year. c. Create a bin of size 10 for the age measure to create a new dimension to show the revenue. d. Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field.

	e. Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. f. Create a calculated field to show the average revenue per state & display profitable & non-profitable state. g. Build a dashboard.
10	Analysis of GDP dataset: a. Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps. b. Create a bar graph to compare GDP of Belgium between 2006 – 2026. c. Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010. d. Visualize the countries Bhutan & Costa Rica competing in terms of GDP. e. Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006. f. Build an interactive dashboard.
11	Analysis of HR Dataset: a. Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. b. Create a Lollipop Chart to show the attrition rate based on gender category. c. Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label. d. Create a bar chart to display the number of employees by Age group, e. Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count. f. Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition – drag education field to rows, sum attrition count to col. g. Create multiple donut charts to show the Attrition Rate by Gender for different Age group.
12	Analysis of Amazon Prime Dataset: a. Create a Donut chart to show the percentage of movie and TV shows. b. Create a area chart to shows by release year and type. c. Create a horizontal bar chart to show Top 10 genre. d. Create a map to display total shows by country. e. Create a text sheet to show the description of any movie/movies. f. Build an interactive Dashboard.

Course Outcomes: After completing the course, the students will be able to	
CO1	Design the experiments to create basic charts and graphs using Tableau and Power BI.
CO2	Demonstrate the ability to connect to different data sources and apply transformations.
CO3	Develop visual solutions for real-world problems using calculated fields, filters, and parameters.
CO4	Analyze the results through data storytelling and dashboard design.
CO5	Apply documentation techniques to produce structured reports detailing the data analysis process and outcomes.

Web links and Video Lectures (e – Resources)	
1.	Microsoft Power BI Dashboards Step by Step by Errin O'Connor, 2019 by Pearson Education, Inc https://lumen.uv.mx/resources/files/documents/2019/8/8/2571/cedc3aa4-276d-4e06-8f50-ea4fa23b3d37.pdf
2.	Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few https://public.magendanz.com/Temp/Information%20Dashboard%20Design.pdf
3.	https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm
4.	https://www.tutorialspoint.com/tableau/index.htm
5.	https://www.simplilearn.com/tutorials/power-bi-tutorial/power-bi-vs-tableau

CO – PO MAPPING

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

Semester: III					
Data Analytics with R					
Course Code	:	BCS308B	**Credits**	:	01
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	50 Marks
Total Hours	:	15P	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	2 Hours

Prerequisites:	
Courses	Introduction to Python Programming.
Knowledge on Fundamental Concepts	Basics of Data Structures, Mathematical Foundations.
Knowledge on Connected Tools (If any)	Linux Editor.

Course Learning Objectives: This course will enable the students to	
CLO1	Gain the knowledge of R Programming Concepts.
CLO2	Emphasis the graphical representation of data.
CLO3	Explore the concept of Statistics in R.
CLO4	Work with R charts and Graphs.

Experiments	
Sl. No.	**List of problems for which student should develop program and execute in the Laboratory**
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.
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.

<table>
<tr><td>3</td><td>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.</td></tr>
<tr><td>4</td><td>Develop a program to find the factorial of given number using recursive function calls.</td></tr>
<tr><td>5</td><td>Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.</td></tr>
<tr><td>6</td><td>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.</td></tr>
<tr><td>7</td><td>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”.
Create another Data Frame called “item-details” with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames.</td></tr>
<tr><td>8</td><td>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.</td></tr>
<tr><td>9</td><td>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”.</td></tr>
<tr><td>10</td><td>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</td></tr>
</table>

	models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a. What is the total number of observations and variables in the dataset? b. Find the car with the largest hp and the least hp using suitable functions. c. Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness? d. What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e. Which pair of variables has the highest Pearson correlation?
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.
12	Write R script a. to read and write excel. b. to read and write csv file. c. to work with Database file.
13	Write R script a. Write R script to create bar chart (3 different styles preferable). b. Write R script to create Line graph (3 different styles preferable). c. Write R script to create pie chart (5 different styles preferable). d. Write R script to create Histogram.

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the graphical packages of R for effective data visualization.
CO2	Apply various statistical analysis methods for performing data analytics.
CO3	Analyze the structures and components of R programming.
CO4	Evaluate the basics of data preparation using real-world examples.
CO5	Develop data-driven solutions by integrating file handling, data manipulation, and automation techniques in R programming.

Web links and Video Lectures (e – Resources)	
1	http://www.tutorialspoint.com/r/r_tutorial.pdf
2	https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
3	https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
4	https://www.w3schools.com/r/r_stat_data_set.asp
5	https://rpubs.com/BillB/217355

CO – PO MAPPING

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

Semester: III					
Project Management with Git					
Course Code	:	BCS308C	**Credits**	:	01
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	50 Marks
Total Hours	:	14P	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	2 Hours

Prerequisites:	
Courses	Problem solving through programming, Introduction to python programming.
Knowledge on Fundamental Concepts	File Handling, shell/terminal usage and Basic CLI Navigation.
Knowledge on Connected Tools (If any)	IDLEs.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts and workflow of version control systems like Git.
CLO2	Apply Git commands to manage code repositories, including staging, committing, branching, and merging.
CLO3	Collaborate effectively using remote repositories by performing cloning, pushing, pulling, and rebasing.
CLO4	Utilize Git tools Such as tagging, stashing, and cherry-picking for advanced version v control operations.
CLO5	Analyze and modify Git history for auditing, debugging, or rolling back changes.

Sl. No.	**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 by Changing the current working directory.
5	**Collaboration and Remote Repositories** Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch by git fetch origin and replacing <branch-name> with the name of your local branch by git checkout <branch-name>Command.
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 and annotated 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 "2025-01-01" and "2025-12-31."
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"**.**
Note: • Ensure Git is installed by running git --version in your terminal. Be aware that newer Git versions use main instead of master as the default branch—adjust commands accordingly. • Use commands like git revert and git reset with caution, as they modify commit history—especially in shared repositories.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the steps to initialize a Git repository and the purpose of basic version control commands such as add, commit, and status.
CO2	Illustrate the role of branching and merging strategies in Git during feature development.
CO3	Perform Git stash and rebase operations to manage complex workflows and context switching.
CO4	Describe how to clone remote repositories, synchronize changes, and collaborate with teams on shared codebases.
CO5	Analyze commit history and make informed decisions to revert, cherry-pick, or annotate changes.

Reference Books	
1	Pro Git, Scott Chacon & Ben Straub, 2nd Edition, 2009, Apress®, ISBN:978-1-4842-0076-6.
2	Version Control with Git, Prem Kumar Ponuthorai & Jon Loeliger, , 3rd Edition, 2022, O'Reilly Media, Inc., ISBN: 978-1-4920-9119-6.
3	Learn Git in a Month of Lunches, Rick Umali,1st Edition, 2015, Manning Publications (distributed by Simon & Schuster) ISBN-10: 1617292419.

Web links and Video Lectures (e – Resources)	
1	https://research.computing.yale.edu/sites/default/files/files/Version%20Control%20wit h%20Git%281%29.pdf?utm_source=chatgpt.com
2	https://onlinecourses.swayam2.ac.in/aic20_sp10/preview
3	https://www.youtube.com/watch?v=SNryJ5UDI1w
4	https://www.cccwi.de/wp-content/uploads/2014/03/git-intro.pdf?utm_source=chatgpt.com

CO – PO MAPPING

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

Semester: III					
Data Visualization with Python					
Course Code	:	BCS308D	**Credits**	:	1
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	50Marks
Total Hours	:	15P	**SEE**	:	50Marks
Course Type	:	AEC	**SEE Duration**	:	2 Hours

Prerequisites:	
Courses	Introduction to Python Programming.
Knowledge on Fundamental Concepts	Programming Skills.
Knowledge on Connected Tools (If any)	Jupyter notebook, Anaconda.

Course Learning Objectives: This course will enable the students to	
CLO1	Demonstrate the use of IDLE or PyCharm IDE to create Python Applications.
CLO2	Apply a Python programming language to develop programs for solving real-world problems.
CLO3	Implement of Matplotlib for drawing different Plots.
CLO4	Demonstrate working with Seaborn, Bokeh.
CLO5	Working with Plotly for 3D, Time series and maps.

Sl. No.	**Experiments**
1	a. Design a python program to find the best of two test average marks out of three test's marks accepted from the user. b. Develop a Python program to check whether a given number is palindrome or not also count the number of occurrences of each digit in the input number.
2	Design a function F as Fn = Fn-1 + Fn-2. Develop a Python program which accepts a value for N(where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.
3	a. Design a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. b. Design a Python program to find the string similarity between two given strings.
4	Design a Python program which explains uses of customizing Seaborn plots with Aesthetic functions.
5	a. Design a python program to explain working with Bokeh line graph using Annotations and legends. b. Design a python program for plotting different types of plots using Bokeh.
6	Develop a python program to draw 3D Plots using Plotly Libraries.
7	a. Develop a python program to draw Time Series using Plotly Libraries. b. Design a python program for creating maps using Plotly Libraries.
8	For the given dataset that contains immigration details to Canada from 1980 to 2013, • Create an area plot for top 6 immigrant countries from 1990 to 2013. • Create and year-wise immigrant bar chart from India to Canada during the period of 1980 to 2013.

	• Create a boxplot for Indian, Phillipin and China immigrants. • Show the total no. of immigrants from India and France countries using Area Chart and Pie chart. • Create a scatter Histogram for the immigrants from Fiji and Singapore in the year 2013.
9	For the given data set that contains the data of flights that were on time in January for the years 2019 and 2020. Using the two data sets visualize the data using matplotlib and plotly libraries to depict the following: • Show the difference in statistics for distance for both the years using the appropriate plotting technique. • Visualize the no. of flights whose destination airport id is 11778 and 11267 using a bar plot or bar chart. • Create a Sunburst Plot for both the years depicting the difference among them.
10	Visualize the given Placement Data Full Class dataset that contains details about Campus Recruitment using the below techniques for appropriate dimensions and differentiate between the two techniques: • Histogram and Bar Chart [For histogram let no. of bins = 10]. • Facet Plot and Pair Plot. • Area Chart and Pie Chart [For yes or no data].

Course Outcomes: After completing the course, the students will be able to	
CO1	Use of IDLE or PyCharm IDE to create Python Applications.
CO2	Implement Matplotlib for drawing different types of plots.
CO3	Build an effective 2D visualizations using Matplotlib.
CO4	Design advanced visualizations using Seaborn and Bokeh.
CO5	Develop interactive and advanced 3D/time-series visualizations using Plotly.

Web links and Video Lectures (e- Resources):	
1	Python https://www.youtube.com/watch?v=_uQrJ0TkZlc
2	https://www.geeksforgeeks.org/data-visualization-using-matplotlib/

CO – PO MAPPING

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

Semester: III					
Environmental Studies					
Course Code	:	BES309	**Credits**	:	1
Hours/Week(L:T:P)	:	1:0:0	**CIE**	:	50Marks
Total Hours	:	15L	**SEE**	:	50Marks
Course Type	:	MC	**SEE Duration**	:	1 Hour

Prerequisites:	
Courses	Basic Science
Knowledge on Fundamental Concepts	Environmental
Knowledge on Connected Tools (If any)	–

Course Learning Objectives: This course will enable the students to	
CLO1	Create environmental and sustainability awareness among the students.
CLO2	Creating knowledge of relationship between the biotic and abiotic component.
CLO3	Apply their ecological knowledge to illustrate and grasp the problem and describe the realities that managers face when dealing with complex issues.
CLO4	Develop skills, critical thinking and demonstrate socio-economic for skills Environmental protection.
CLO5	Gain knowledge on different types of pollution in the environment, waste management and Environmental legislation.

Module – 1	**03 Hrs**
Ecosystem and Sustainability: Ecology and Ecosystem: Structure of Ecosystem, components, Types: Forest, Desert, Wetlands, River, Oceanic ecosystems. **Sustainability:** 17SDG targets and possible actions. **Biodiversity:** Types, Value, Hot-spots, Threats and Conservation of biodiversity, Forest Wealth, and Deforestation. **Text Book 1: Ch 1, 2, 3**	
Module – 2	**03 Hrs**
Natural Resource Management **Advances in Energy Systems** (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading. **Text Book 2: Ch 3, 4**	
Module – 3	**03 Hrs**
Environmental Pollution & Waste Management **Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution, Noise pollution; Soil Pollution and Air Pollution. **Waste Management:** Bio-medical Wastes, Solid waste, Hazardous wastes, E-wastes; Industrial and Municipal Sludge. **Text Book 2: Ch 5, 16**	

Module – 4	03 Hrs
Global Environmental Issues Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change, Acid Rain, Ozone Depletion, Radon and Fluoride problem in drinking water, Resettlement and rehabilitation of people, Environmental Toxicology. **Text Book 3: Ch 9, 10**	
Module – 5	**03 Hrs**
Environmental Legislation: Solid Waste Management Rules 2016, Biomedical Waste Management Rules, 2016. BBMP, BWSSB Norms. **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** GIS & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. **Text book 1: Ch 10, 11, 12**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the principles of ecology and environmental issues that apply to air, land and water issues.
CO2	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.
CO3	Conduct survey to describe the realities of waste management system.
CO4	Identify the major challenges of environmental issues on a global scale.
CO5	Apply their environmental legislation to illustrate problems and describe the realities that managers face when dealing with complex issues.

Text Books	
1	Environmental Studies, Benny Joseph, 2005, Tata McGraw – Hill Publishing Company Limited, ISBN: 9352605179.
2	Environmental Studies, S.M. Prakash, 2007, Elite Publishers Mangalore ISBN: 9780857096364.
3	Environmental Studies – From Crisis to Cure, R Rajagopalan, 2005, Oxford University Press, ISBN: 978-0199459759.

Reference Books	
1	Environmental Studies, R.J.Ranjit Daniels and Jagadish Krishnaswamy, 2009, Wiley India Private Ltd, New Delhi, ISBN: 8126519436.
2	Environmental Science – working with the Earth, G.Tyler Miller Jr., 10th Edition, 2004, Thomson Brooks /Cole, ISBN-10: 0495106704.
3	Elements of Environmental Science and Engineering, P. Meenakshi, 2006, Prentice Hall of India Private Limited, New Delhi, ISBN-10: 9788120345232.

Web links and Video Lectures (e – Resources)	
1	https://sdgs.un.org/goals
2	https://archive.nptel.ac.in/courses/109/105/109105190/
3	https://kspcb.karnataka.gov.in/waste-management/biomedical-waste

CO – PO MAPPING

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

Semester: III					
National Service Scheme					
Course Code	:	BNS310	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	12P	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the community in general in which they work.
CLO2	Identify the needs and problems of the community and involve them in problem –solving.
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions.
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Activity– 1	**08 Hrs**
Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	
Activity – 2	**08 Hrs**
Waste management– Public, Private and Govt. organization, 5 R's.	
Activity – 3	**08 Hrs**
Setting of the information imparting club for women leading to contribution in social and economic issues.	

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	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/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 NSS officer
2	Waste management Public, Private and Govt	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/	Site selection /proper consultation/ Continuous monitoring/	Report should be submitted by individual	Evaluation as per the rubrics Of scheme and syllabus by

	organization, 5 R's.		Government Schemes officers/ campus etc.	Information board	to the concerned evaluation authority	NSS officer
3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt. Teams / 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 NSS officer

Plan of Action

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

- In the 3rd semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 3rd semester, consolidated report of all activities compiled report should be submitted as per the instructions.

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

Assessment Details for CIE

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

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

CO-PO Mapping

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

Semester: III					
Physical Education (PE) (Sports & Athletics)					
Course Code	:	BPE310	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:1	**CIE**	:	100 Marks
Total Hours	:	12P	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop awareness about personal health, wellness, and the importance of an active lifestyle through pre-fitness evaluation and orientation.
CLO2	Improve general physical fitness through structured training in strength, speed, and warm-up exercises.
CLO3	Acquire sport-specific skills and techniques in traditional games such as Kabaddi or Kho-Kho through practical sessions.

Module – 1	**4 Hrs**
Orientation a. Lifestyle. b. Health & Wellness. c. Pre-Fitness test.	
Module – 2	**4 Hrs**
General Fitness & Components of Fitness a. Warming up (Free Hand exercises). b. Strength – Push-up / Pull-ups. c. Speed – 30 Mtr Dash.	
Module-3	**16 Hrs**
Specific games (Anyone to be selected by the student) a. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. b. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate core concepts of physical education, health, nutrition and fitness for personal well-being.
CO2	Demonstrate exercises, sports and practices that enhance physical and mental development.
CO3	Apply foundational skills for careers in physical education, sports and fitness.
CO4	Participate in sports competitions with discipline, teamwork and sportsmanship.
CO5	Promote healthy lifestyles through wellness concepts and traditional/indigenous activities.

Scheme and Assessment for auditing the course and Grades:

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

CO – PO MAPPING

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

Semester: III					
Yoga					
Course Code	:	BYO310	**Credits**	:	-
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	12P	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the history, various schools of yoga along with its aims, objectives and significance in holistic well-being.
CLO2	Demonstrate basic yoga practices and how to do them safely, clearing up common misunderstandings.
CLO3	Apply suryanamaskara with proper understanding of its structure, significance and health benefits.
CLO4	Describe the types, methods and benefits of various Asanas.
CLO5	Utilize the knowledge of specific asanas regularly to improve physical health and mental well-being.

Module - 1	**05 Hrs**
Introduction to Yoga: Origin, history, and development of Yoga, Meaning and definitions of Yoga, Different schools of Yoga, Aims and objectives of Yoga, Importance of prayer in Yoga practice. **Text Book 1: Ch 1 (Part 1)**	
Module - 2	**05 Hrs**
Foundations of Yogic Practice: Yogic practices for a common man to promote positive health, Rules to be followed during yogic practices by the practitioner, Misconceptions about Yoga, Difference between yogic and non-yogic practices. **Text Book 1: Ch 1 (Part 1)**	
Module - 3	**05 Hrs**
Suryanamaskara (Sun Salutation): Prayer and its meaning, Need, Importance and benefits of Suryanamaskara, 12-count structure and practice of 2 rounds. **Text Book 1: Ch 2 (Part 2)**	
Module - 4	**05 Hrs**
Introduction to Asanas: Asana - Meaning, need, and importance, Classification of Asanas, General technique, precautionary measures, and benefits of each Asana. **Text Book 1: Ch 1 & 2 (Part 1 & 2)**	
Module - 5	**04 Hrs**
Types of Asanas and Practice: Sitting Asanas - Padmasana, Vajrasana, Standing Asanas - Vrikshasana, Trikonasana, Prone Lying Asanas - Bhujangasana, Shalabhasana, Supine Lying Asanas - Utthitadvipadasana, Ardhahalasana. **Text Book 1: Ch 2 (Part 2)**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the history and major schools of yoga, highlighting their purpose in promoting holistic well-being.
CO2	Demonstrate basic yoga practices with correct techniques, ensuring safety and addressing common misconceptions.
CO3	Apply suryanamaskara sequences with proper understanding of its structure, significance, and health benefits.
CO4	Classify the types, methods, and benefits of various asanas with appropriate examples.
CO5	Adopt the practice of specific asanas into a regular routine to enhance physical health and mental well-being.

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

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

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

CO – PO MAPPING

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

Semester: III					
Music					
Course Code	:	BMU310	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	12P	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Objectives: This course will enable the students to	
CLO1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
CLO2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
CLO3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
CLO4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
CLO5	Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi.

Module – 1	**03 Hrs**
Preamble Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **Text Book 1: V-1 Ch 1-4**	
Module – 2	**03 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **Text Book 2: Ch 4-7**	
Module – 3	**03 Hrs**
Composers Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa. **Text Book 3: Ch 2-5**	
Module – 4	**03 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Text Book 1: V-4 Ch 2-6**	

Module – 5	12 Hrs
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga. **Text Book 1: V-1&2**	

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

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

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

CO – PO MAPPING

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

Semester: III					
Competency Enhancement Course-1					
Course Code	**:**	BCE311	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	2:0:0	**CIE**	**:**	100 Marks
Total Hours	**:**	40L	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Fundamentals of Mathematics & English.
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals, and elementary algebra. comprehension of basic English.
Knowledge on Connected Tools	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Gain a strong foundation in aptitude skills such as number systems, percentages, ratio & proportion and interest calculations to improve quantitative reasoning and problem-solving efficiency.
CLO2	Apply Vedic Mathematics techniques and shortcuts for rapid mental calculations, leading to increased accuracy and speed in aptitude-based assessments.
CLO3	Master logical reasoning topics like syllogisms, blood relations, puzzles and seating arrangements to develop structured thinking and effective decision-making skills.
CLO4	Understand and solve problems involving coding-decoding, visual sequences, clocks, calendars and analogies to enhance pattern recognition and reasoning speed.
CLO5	Utilize aptitude and reasoning skills to perform well in competitive exams, campus placements, and workplace situations, contributing to overall academic and professional success.

Module – 1	**08 Hrs**

Introduction to Aptitude and Vedic Mathematics

Understanding Aptitude

Overview of aptitude skills and their significance in problem-solving and decision-making. Types of aptitude skills commonly assessed in competitive exams and professional settings.

Vedic Mathematics Techniques

Introduction to Vedic Mathematics for faster and more efficient calculations. Key techniques and shortcuts to improve speed and accuracy in quantitative problems.

Importance of Aptitude Skills

The role of aptitude in career development and academic success. How strong aptitude skills enhance analytical thinking, logical reasoning, and performance in assessments.

Number System

Divisibility & Remainder, Multiples & Factors, Integers, LCM & HCF, Complete a number Series, Find the Missing Term and Wrong Term, Simplification, BODMAS Rule, Approximation, Decimals, Fractions, Surds & Indices.

Text Book 1: Ch 1-11

Module – 2	08 Hrs

Percentage

Calculation-oriented basic percentage, Successive Selling type, Discount & MP, Dishonest Dealings.

Profit and Loss

Cost Price (CP), Selling Price (SP), Marked Price (MP) / List Price, Discount, Profit (Gain), Loss, Profit Percentage, Loss Percentage, Discount Percentage, Relationship between CP, SP, and Profit/Loss Percentage, Successive Profits and Losses, False Weights and Dishonest Dealer Problems.

Blood Relation

Basic Family Relationships (Parent, Sibling, Child, etc.), Direct Relationship Questions, Pointing or Introducing Type Questions, Family Tree/Hierarchical Relationship Questions, Coded Blood Relations, Puzzle-Based Blood Relations, Mixed/Complex Blood Relations, Single-Person Blood Relation Problems, Generational Relationships (Grandparent, Great-Grandparent, etc.), Relationships by Marriage (In-laws, Step-relations).

Text Book 3: Ch2, 3, 4, 6, 7, 10, 12

Module-3	08 Hrs

Simple and Compound Interest

Definition of Simple Interest (SI), Calculation of Simple Interest, Principal, Rate, and Time, Amount in Simple Interest, Problems on SI (Direct, Inverse and Combined), Definition of Compound Interest (CI), Calculation of Compound Interest (Annual, Half-yearly, Quarterly, etc.), Difference between Simple and Compound Interest, Growth Factor and Compound Amount, Compound Interest for Fractional Years, Comparing SI and CI over Multiple Years, Depreciation and Appreciation Problems, Installment Payments (EMI-based Questions).

Averages

Definition and Formula of Average, Average of Numbers, Average of Consecutive Numbers, Average of Odd/Even Numbers, Weighted Average, Average in Groups (Merging and Replacement), Effect of Addition/Removal/Replacement on Average, Average Speed, Change in Average Due to Error (Wrong Entry), Shortcut Tricks and Applications.

Direction Sense Test

Cardinal and intermediate directions, right and left directional movement, reference points and orientation, turns and angle-based movement, distance and displacement calculation, shadow and sun-based direction problems, shortest path and final position, direction sense using maps or diagrams, coded direction sense problems, complex/multiple person direction scenarios, error spotting in direction sense.

Text Book 1: Ch 2, 5

Module-4	08 Hrs

Ratio and Proportion and Variations

Definition of Ratio, Types of Ratio (Simple, Compound, Duplicate, Sub-duplicate, Triplicate), Properties of Ratio, Comparison of Ratios, Definition of Proportion, Types of Proportion (Direct, Inverse, Continued), Properties of Proportion, Mean Proportion, Fourth Proportion, Third Proportion, Relationship between Ratios and Proportions, Componendo and Dividendo Rules, Addendo and Subtrahendo, Applications of Ratio and Proportion in Problem, Direct Variation, Inverse Variation, Joint Variation, Combined Variation, Proportionality Constants, Word Problems on Variation, Application-based Variation Problems, Miscellaneous and Complex Variation Questions.

Alligations and Mixtures

Definition of Alligation, Alligation Rule and Formula, Types of Mixtures (Simple and Compound), Problems on Mixing Two or More Quantities, Mean Price Calculation, Replacement of Quantities, Alligation on Solutions with Different Concentrations, Solving Alligation Questions Involving Profit and Loss, Application-Based Mixture Problems.

Series

Arithmetic Series, Geometric Series, Square Series, Cube Series, Fibonacci Series, Prime Number Series, Alternating Series, Factorial Series, Mixed Series, Exponential/Power Series.

Text Book 1: Ch 12, 13, 16

Module-5	**08 Hrs**

Articles and Prepositions

Usage of articles (a, an, the), definite and indefinite articles, zero article usage, prepositions of time, place, direction, phrasal verbs, prepositional phrases, and error spotting.

Tenses and Subject-Verb Agreement

Present, past, and future tense forms, auxiliary verbs, rules of agreement with different subjects, and error spotting.

Change of Voice and Speech

Active-passive transformations in all tenses, direct and indirect speech conversions, and related pronoun, tense, and time changes.

Error Spotting and Sentence Correction

Identifying common grammatical errors such as incorrect word usage, faulty subject-verb agreement, tense errors, sentence fragments, and contextual sentence corrections.

Synonyms, Antonyms, and Verbal Analogy

Finding words with similar or opposite meanings, commonly confused words, verbal analogies, and contextual vocabulary usage.

Sentence Completion and One-Word Substitution

Choosing appropriate words or phrases to complete sentences, idiomatic expressions, logical sentence completion, and replacing phrases with single-word substitutes.

Text Book 1: Ch14, 15, 17, 29

Course Outcomes: After completing the course, the students will be able to	
CO1	Solve numerical problems using Vedic Math and number systems to boost speed and accuracy.
CO2	Apply logical reasoning to puzzles, syllogisms, seating and classification problems.
CO3	Develop letter, number and symbol patterns and solve visual reasoning tasks.
CO4	Accurately solve problems on percentages, profit-loss, interest, ratios and partnerships.
CO5	Utilize aptitude and reasoning skills to excel in competitive exams and improve employability.

Text Books	
1	Quantitative Aptitude for Competitive Examinations, R.S. Aggarwal, 2023, Chand Publishing.
2	Vedic Mathematics, Bharati Krishna Tirthaji, Sixteenth Reprint, 1985, Motilal Banarsidass Publishers, ISBN- 978-8120801639.

3	Logical and Analytical Reasoning, A.K. Gupta, 39th Edition, 2024, Ramesh Publishing House, ISBN- 978-9350127766.

Reference Books	
1	Puzzle Test & Seating Arrangements, K. Kundan, 1st Edition, 2023 BSC Publishing Company Pvt Ltd., ISBN: 9789394666023.
2	Logical Reasoning and Data Interpretation for the CAT, Nishit K. Sinha, 7th Edition, 2020, Pearson Education, ISBN: 978-9353946616.

Web links and Video Lectures (e –Resources)	
1	https://www.youtube.com/watch?v=ZXcULvjpQlM
2	https://www.youtube.com/watch?v=ZXcULvjpQlM
3	https://www.youtube.com/watch?v=OHZ40sOT7mk
4	https://www.youtube.com/watch?v=9UtPPSX_vnk
5	https://www.youtube.com/watch?v=DIbjA3b21ow

CO – PO MAPPING

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

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

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

Department Vision

Building up-skilled Computer Professionals, enriched with interactive design skills as to serve the dynamic needs of the Industry and Society

Department Mission

- Develop Innovative, Proficient and ethically strong Computer Design Engineers with design skills to meet Universal Challenges.
- Nurture competence as well as Applied Research activities to solve concrete problems.
- Aspire for constant up-gradation of engineering skills to cater the needs of the Corporate and Society.
- Imbibing the spirit of teamwork, core skills, professionalism and confidence to take the Leadership role.
- Inculcate Research culture to design and develop smart computing solutions for Humanity and Nation.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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