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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

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

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



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

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

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

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

7th Semester

Computer Science and Engineering													
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**					
					L	**T**	**P**	**SEE Duration (Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BCS701	Parallel Computing	IPCC	CSE	3	0	2	**3**	**50**	**50**	**100**	**4**
2	BIS702	Big Data Analytics	IPCC	CSE	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BCS703	Cryptography and Network Security	PCC	CSE	4	0	0	**3**	**50**	**50**	**100**	**4**
4	BXX724x	Professional Elective Course – IV	PEC	CSE	3	0	0	**3**	**50**	**50**	**100**	**3**
5	BXX745x	Open Elective Course – II	OEC	CSE	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BCS736	Major Project Phase – II	PROJ	CSE	0	0	12	**3**	**100**	**100**	**200**	**6**
7	BCR707	Career Readiness and Industry Integration	NCMC	CDCAC	0	2	0	-	**100**	-	**100**	**0**
									450	**350**	**800**	**24**

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

Professional Elective Course – IV			
Course Code	**Course Name**	**Course Code**	**Course Name**
BCS724A	Robotic Process Automation Design and Development	BIS724C	Deep Learning
BCS724B	Virtual and Augmented Reality	BCS724D	Natural Language Processing
Open Elective Course – II			
Course Code	**Course Name**	**Course Code**	**Course Name**
BCS745A	Introduction to Database Management	BIS745C	Software Engineering

	System		
BCS745B	Introduction to Algorithms	BIS745D	Web Technologies

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.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Work: The objective of the Project work is to:

i) Encourage independent learning and the innovative attitude of the students.
ii) Develop interactive attitude, communication skills, organization, time management, and presentation skills.
iii) Impart flexibility and adaptability.
iv) Inspire team working.
v) Expand intellectual capacity, credibility, judgment and intuition.
vi) Adhere to punctuality, setting and meeting deadlines.
vii) Install responsibilities to oneself and others.
viii) Train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Semester: VII					
Parallel Computing					
Course Code	**:**	BCS701	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40L+20P	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Organization & Architecture, OS and C / C++ / Java / Python programming.
Knowledge on Fundamental Concepts	CPU and memory hierarchy, Multicore processors / GPUs, Control structures, Pointers and memory management.
Knowledge on Connected Tools (If any)	OpenMP, Message Passing Interface, Compute Unified Device Architecture.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the principles, architectures, and memory models of parallel computing.
CLO2	Interpret the execution behavior and performance characteristics of MIMD and GPU-based parallel systems
CLO3	Identify the use of MPI library functions to parallelize programs on distributed-memory systems
CLO4	Demonstrate the use of OpenMP pragmas and directives to parallelize shared-memory programs
CLO5	Employ the design and execution of CUDA programs for GPU-based parallel computing.

Module – 1	**08Hrs**
Introduction to parallel programming, Parallel hardware and parallel software-Classifications of parallel computers, SIMD systems, MIMD systems, Interconnection networks, Cache coherence, Shared-memory vs. distributed-memory, Coordinating the processes/threads, Shared-memory, Distributed-memory. **Textbook 1: Ch. 2:** 2.3 – 2.4	
Module – 2	**08Hrs**
GPU programming, Programming hybrid systems, MIMD systems, GPUs, Performance — Speedup and efficiency in MIMD systems, Amdahl's law, Scalability in MIMD systems, Taking timings of MIMD programs, GPU performance. **Textbook 1: Ch. 2:** 2.5 – 2.6	
Module – 3	**08Hrs**
Distributed memory programming with MPI — MPI functions, The trapezoidal rule in MPI, Dealing with I/O, Collective communication, MPI-derived datatypes, Performance evaluation of MPI programs, A parallel sorting algorithm. **Textbook 1: Ch. 3:** 3.1 – 3.7	
Module – 4	**08Hrs**
Shared-memory programming with OpenMP — openmp pragmas and directives, The trapezoidal rule, Scope of variables, The reduction clause, loop carried dependency, scheduling, producers and consumers, Caches, cache coherence and false sharing in openmp, tasting, tasting, thread safety.	

Textbook 1: Ch. 5: 5.1 – 5.11	
Module – 5	**08Hrs**
GPU programming with CUDA - GPUs and GPGPU, GPU architectures, Heterogeneous computing, Threads, blocks, and grids Nvidia compute capabilities and device architectures, Vector addition, Returning results from CUDA kernels, CUDA trapezoidal rule I, CUDA trapezoidal rule II: improving performance, CUDA trapezoidal rule III: blocks with more than one warp. **Textbook 1: Ch. 6:** 6.1 – 6.13	

PRACTICAL COMPONENT OF IPCC

SL.NO.	Programs
1	Write a OpenMP program to sort an array on n elements using both sequential and parallel mergesort(using Section). Record the difference in execution time.
2	Write an OpenMP program that divides the Iterations into chunks containing 2 iterations, respectively (OMP_SCHEDULE=static,2). Its input should be the number of iterations, and its output should be which iterations of a parallelized for loop are executed by which thread. For example, if there are two threads and four iterations, the output might be the following: a. Thread 0 : Iterations 0 - 1 b. Thread 1 : Iterations 2 - 3
3	Write an OpenMP program to calculate n Fibonacci numbers using tasks.
4	Write an OpenMP program to find the prime numbers from 1 to n employing the parallel for directive. Record both serial and parallel execution times.
5	Write an MPI Program to demonstrate MPI_Send and MPI_Recv.
6	Write a MPI program to demonstration of deadlock using point to point communication and avoidance of deadlock by altering the call sequence.
7	Write a MPI Program to demonstration of Broadcast operation.
8	Write a MPI Program demonstration of MPI_Scatter and MPI_Gather.
9	Write a MPI Program to demonstration of MPI_Reduce and MPI_Allreduce (MPI_MAX, MPI_MIN, MPI_SUM, MPI_PROD).

Course Outcomes: After completing the course, the students will be able to	
CO1	Illustrate the concepts of SIMD, MIMD, interconnection networks, and cache coherence.
CO2	Analyze the architecture and execution models of MIMD and GPU-based systems.
CO3	Apply MPI libraries to develop distributed memory parallel programs for solving computational problems.
CO4	Develop shared-memory parallel programs using OpenMP directives and synchronization techniques.
CO5	Design CUDA-based programs to solve computationally intensive problems using GPUs.

Textbooks	
1	"An Introduction to Parallel Programming", Peter S Pacheco, Matthew Malensek —, second edition 2020, Morgan Kauffman ISBN: 978-0128046050.
2	"Parallel Programming in C with MPI and OpenMp", Michael J Quinn, McGrawHill. FIRST edition, 2017, ISBN: 978-0070582019.

Reference Books	
1	Calvin Lin, Lawrence Snyder – Principles of Parallel Programming, Pearson. 2008, ISBN: 978-0321487902.
2	Barbara Chapman – Using OpenMP: Portable Shared Memory Parallel Programming, Scientific and Engineering Computation. Scientific and Engin EDITION, 2007, ISBN: 978-0262533027.
3	William Gropp, Ewing Lusk – Using MPI:Portable Parallel Programing, Third edition, Scientific and Engineering Computation. Third edition2014, ISBN: 978-0262527392.

Web links and Video Lectures (e – Resources)	
1	Introduction to parallel programming: https://nptel.ac.in/courses/106102163
2	https://www.youtube.com/watch?v=pnGbjr0HM1k
3	https://www.youtube.com/watch?app=desktop&v=yi3zHpgGXpk&t=0s
4	https://www.youtube.com/watch?v=pn0EDrR3xtA

CO – PO – PSO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2			1						1	2	1
CO2	3	3		2	2						2	2	2
CO3	2	2	3	2	3			1			2	3	3
CO4	2	2	3	2	3			2			2	3	3
CO5	2	3	3	2	3			1			2	3	3

Semester:VII					
BIG DATA ANALYTICS					
Course Code	**:**	BIS702	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50Marks
Total Hours	**:**	40L + 14P	**SEE**	**:**	50Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Database Management System, Operating System.
Knowledge on Fundamental Concepts	Basics of Networks and Machine Learning
Knowledge on Connected Tools (If any)	Basic knowledge on AWS, Microsoft Azure, Google Cloud, Hadoop

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the concepts, characteristics, and evolution of Big Data.
CLO2	Apply Hadoop ecosystem components, including HDFS, YARN, and MapReduce.
CLO3	Implement MapReduce programs for processing big data.
CLO4	Realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
CLO5	Analyze big data using machine learning techniques.

Module – 1	**08Hrs**

Introduction: Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data,Typical data warehouse and Hadoop environment.

Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools , NoSQL, Hadoop.

Text Book 1: Ch 1: 1.1, Ch 2: 2.1-2.5,2.7,2.9-2.11, Ch 3: 3.2,3.5,3.8,3.12, Ch 4: 4.1,4.2

Module – 2	**08Hrs**

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System),Processing data with Hadoop, Managing resources and applications with Hadoop YARN(Yet Another Resource Negotiator).

Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression

Text Book 1: Ch 5: 5.1-,5.8, 5.10-5.12, Ch 8: 8.1 - 8.8

Module – 3	**08Hrs**

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

Text Book 1: Ch 6: 6.1-6.5

Module – 4	08Hrs
Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). **Introduction to Pig:** What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive. **Text Book 1: Ch 9: 9.1-9.6,9.8, Ch 10: 10.1 - 10.15, 10.22**	
Module – 5	**08Hrs**
Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark. **Text, Web Content and Link Analytics:** Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph. **Text Book 2: Ch 5: 5.2,5.3, Ch 9: 9.1-9.4**	

PRACTICAL COMPONENT

Sl. No.	Experiments (Java/Python/R)
1.	Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files and directories. **Hint:** A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
2.	Develop a MapReduce program to implement Matrix Multiplication
3.	Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.
4.	Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
5.	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB
6.	Write Pig Latin scripts to sort, group, join, project, and filter the data.
7.	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
8.	Implement a word count program in Hadoop and Spark.
9.	Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets

Course Outcomes : After completing the course, the students will be able to	
CO1	Understand Big Data concepts, characteristics, evolution, and analytics.

CO2	Analyze the Hadoop architecture, HDFS, YARN, and MapReduce programming.
CO3	Inference MongoDB concepts and its applications.
CO4	Interpret Hive and Pig architectures, query languages, and their differences.
CO5	Apply Spark for Big Data Analytics and perform text and web analytics.

TextBooks	
1	Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.ISBN 13 9788126554782
2	Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019. ISBN 789353164973

ReferenceBooks	
1	Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012 ISBN: 978-1-449-32717-0
2	Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015. ISBN: ISBN: 9781491901687
3	Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016 ISBN-13: 978-0-13-429107-9 ISBN-10: 0-13-429107-7
4	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition ISBN: 0262537559, 9780262537551

Web links and Video Lectures (e – Resources)	
1	https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
2	https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
3	https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&in dex=4
4	https://www.youtube.com/watch?v=GG-VRm6XnNk https://www.youtube.com/watch?v=JglO2Nv_92A

CO – PO MAPPING

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

Semester: VII					
Cryptography and Network Security					
Course Code	**:**	BCS703	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	4:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	50Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Discrete Mathematics, Programming Fundamentals.
Knowledge on Fundamental Concepts	Encryption/Decryption, cryptographic algorithms, key management, and network security protocols
Knowledge on Connected Tools (If any)	CISCO Packet Tracer, NS2/NS3

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts of computer and network security and cryptographic principles.
CLO2	Explore classical and modern encryption techniques and their applications.
CLO3	Analyze public-key cryptography mechanisms such as RSA and elliptic-curve cryptography.
CLO4	Comprehend the functioning and significance of cryptographic hash functions, key management, and user authentication systems.
CLO5	Explore web security mechanisms, secure email protocols, and IP security for safeguarding network communications.

Module – 1	**10Hrs**
Computer And Network Security Concepts: A model for Network Security **Classical Encryption Techniques:** Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography. **Block Ciphers And Data Encryption Standards:** Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles. **Textbook 1**: **Ch. 1:** 1.8**, Ch. 3:** 3.1, 3.2, 3.5, **Ch. 4:** 4.1- 4.5	
Module – 2	**10Hrs**
Pseudorandom number Generators: Linear Congruential Generators, Blum Shub Generator. **Public key cryptography and RSA:** Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public Key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA. **Diffie-Hellman key exchange:** The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography. **Textbook 1**: **Ch. 8:** 8.2**, Ch. 9:** 9.1, 9.2**, Ch. 10:** 10.1, 10.4	
Module – 3	**10Hrs**

Applications of Cryptographic Hash functions, Two simple Hash functions. **Key management and distribution:** Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 Certificates, Public Key Infrastructures. **Textbook 1**: **Ch. 11:** 11.1, 11.2, **Ch. 14:** 14.1-14.5
Module – 4 **10Hrs**
User Authentication: Remote user authentication principles, Kerberos, Remote user authentication using asymmetric encryption. Web security consideration, Transport layer security. Email Threats and comprehensive email security, S/MIME, Pretty Good Privacy. **Textbook 1: Ch. 15:** 15.1, 15.3, 15.4, **Ch. 17:** 17.1, 17.2**, Ch. 19:** 19.3, 19.4, 19.5
Module – 5 **10Hrs**
Domain Keys: Identified Mail. **IP Security:** IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange. **Textbook 1**: **Ch. 19:** 19.9, **Ch. 20:** 20.1-20.5

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the concepts and models of network security and apply classical encryption techniques.
CO2	Analyze symmetric and asymmetric cryptographic algorithms such as RSA and elliptic curve cryptography.
CO3	Demonstrate the use of cryptographic hash functions, key distribution, and key management techniques.
CO4	Apply principles of user authentication, web security protocols, and secure email communication methods in network security applications.
CO5	Comprehend advanced network security mechanisms such as Domain Keys Identified Mail (DKIM), IP Security (IPSec), and secure transport protocols to ensure end-to-end data protection.

Textbook	
1	"Cryptography and Network Security: Principles and Practice", William Stallings, 7th Edition, 2017, Pearson Education, ISBN: 978-93-325-8522-5**.**

Reference Books	
1	"Network Security: Private Communication in a Public World", Charlie Kaufman, Radia Perlman, Mike Speciner, 2nd Edition, 2002, Pearson Education Asia, ISBN: 978-81-7808-507-4.
2	"Cryptography and Network Security", Behrouz A. Forouzan, 1st Edition, 2007, Tata McGraw-Hill, ISBN: 978-0-07-062638-6.

Web links and Video Lectures (e – Resources)	
1	https://cs221.stanford.edu
2	https://nptel.ac.in/courses/106102220

CO – PO – PSO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	2					1				1	1	1
CO2	2	2	2				1				1	1	1
CO3	2	2					1				1	1	1
CO4	2	2	2	2	1		1				1	1	1
CO5	2	2			1		1				1	1	1

Semester: VII					
Robotic Process Automation Design and Development					
Course Code	**:**	BCS724A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming language, web Application development with HTML and PHP, Software Engineering and elements of mechanics
Knowledge on Fundamental Concepts	Understanding of flowcharts, cloud vs on-premise concepts, and basic automation logic.
Knowledge on Connected Tools (If any)	UiPath Studio, task recorders, OCR, and version control tools like Git.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamentals, history, benefits, limitations, and future trends of RPA.
CLO2	Identify RPA platforms, install UiPath, and use record-and-play to build automation.
CLO3	Describe and implement control flows, data manipulation, and variable handling using UiPath.
CLO4	Demonstrate interaction with UI controls, screen scraping, OCR usage, and control activities.
CLO5	Comprehend exception types, and demonstrate debugging, logging, and crash-handling techniques in RPA.

Module – 1	**08Hrs**
RPA Foundations- What is RPA - Flavors of RPA- History of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- 0CR- Databases-APls- Al-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 Devops- Flowcharts. **Textbook 1: Ch. 1, Ch. 2**	
Module – 2	**08Hrs**
RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder. **Textbook 2: Ch. l, Ch. 2**	
Module – 3	**08Hrs**

Sequence, Flowchart, and Control Flow-sequencing the workflow- Activities- Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation- Variables and Scope Collections-Arguments - Purpose and use-Data table usage with examples Clipboard management-File operation with step-by- step example-CSV/Excel to data table and vice versa [with a step-by-step example). **Textbook 2: Ch. 3**

Module – 4	**08Hrs**
Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of OCR available- How to use OCR- Avoiding typical failure points. **Textbook 2: Ch. 5**	

Module – 5	**08Hrs**
Exception handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screen shots Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA **Text book 1: Ch. 13**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the basic concepts of RPA
CO2	Describe various components and platforms of RPA
CO3	Create automation workflows using sequences, flowcharts, data tables, arguments, and file operations.
CO4	Apply OCR and automation using UiExplorer, screen scraping, and event handling in robotic workflows.
CO5	Analyze exception handling, logging methods, and debugging strategies to improve RPA reliability.

Textbooks	
1	"The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Tom Taulli, 2020, lSBN-13 (electronic):978-7-4842-5729-6, Publisher : A press
2	"Learning Robotic Process Automation", Alok Mani Tripathi, Packet Publishing, ISBN: 9787788470940, 2018

Reference Books	
1	"lntroduction to Robotic Process Automation: a Primer", Frank Casale, Rebecca Dilla, Iieidi Jaynes, Lauren Livingston, Institute of Robotic Process Automation.
2	"Robotic Process Automation: Guide' Building Software Robots", Richard Murdoch, Automate Repetitive Tasks & Become an RPA Consultant.
3	"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Srikanth Merianda.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/@UiPath
2	https://docs.uipath.com/?utm_source

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2										2	2	1
CO2	2										2	3	2
CO3	3	2	1	1		2	1				2	3	3
CO4	3	2	1		2	2	1				2	3	2
CO5	3	2	2			2	1				2	2	3

Semester: VII					
Virtual and Augmented Reality					
Course Code	**:**	BCS724B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Graphics, human-computer interaction, and multimedia systems
Knowledge on Fundamental Concepts	2D – 3D modeling, Rendering, Animation
Knowledge on Connected Tools (If any)	Unity, Unreal Engine, OpenCV, AR-ToolKit

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce the concepts, characteristics, and key elements of Virtual and Augmented Reality systems.
CLO2	Examine the technologies and devices that enable user interaction and sensory feedback in VR/AR systems.
CLO3	Apply different modeling techniques such as geometric, physical, and behavioral modeling in virtual spaces.
CLO4	Analyze interaction techniques and audio rendering in immersive VR/AR environments.
CLO5	Develop knowledge of Augmented Reality technologies, toolkits, tracking techniques, and software libraries.

Module – 1	**08Hrs**
Introduction to Virtual Reality (VR): Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace. **Bird's-Eye View:** Hardware, Software, Human Physiology and Perception. **Text Book 2: Ch. 1:** 1.1 - 1.3, **Ch. 2:** 2.1 - 2.3	
Module – 2	**08Hrs**
Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays & haptic feedback. **Text Book 1: Ch. 2:** 2.1 - 2.3, **Ch. 3:** 3.2, **Ch. 4:** 4.1, 4.2	
Module – 3	**08Hrs**
Modeling: Geometric modeling, Kinematics modeling, Physical modeling, Behavior modeling, Model management. **Text Book 1: Ch. 6:** 6.1 -6.2,6.3(6.3.1,6.3.2(6.3.2.1, 6.3.2.2)),6.4-6.5	
Module – 4	**08Hrs**

Interaction & Audio: Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Text Book 1: Ch. 6: 6.5, **Text Book 2: Ch.10:** 10.1 - 10.4, **Ch.11:** 11.1 - 11.3

08Hrs

Augmented Reality (AR): Terminology, Simple augmented reality, Augmented reality as an emerging technology, Augmented reality applications, Multi-sensory augmented reality, Toolkits and libraries.
Marker-based tracking: Marker detection, Marker pose.

Text Book 3: Ch. 2: 2.1 - 2.6, **Ch. 3:** 3.1 - 3.2

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the concept of virtual reality and Communication Media.
CO2	Discuss the role of hardware and software systems in enabling VR/AR experiences.
CO3	Apply modeling strategies to construct realistic and interactive virtual environments.
CO4	Design VR scenarios that include physical interaction, social behavior modeling, and spatial audio rendering.
CO5	Analyze AR features using toolkits, camera calibration, and marker-based tracking with real- world examples.

Textbooks	
1	"Virtual Reality Technology", Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017, ISBN: 978-1-119-48572-8.
2	"Virtual Reality", First Edition, Steven M. LaValle, Cambridge University Press, 2016. ISBN-13: 978-1107198937 https://msl.cs.uiuc.edu/vr/vrbookbig.pdf
3	"Theory and Applications of Marker-Based Augmented Reality", Sanni Siltanen, VTT Science Series No. 3, VTT Technical Research Centre of Finland, Espoo, Finland, 2012, ISBN: 978-951-38-7450-6

Reference Books	
1	"Computer Graphics with Virtual Reality System", Rajesh K. Maurya, 3rd Edition, Wiley Publication, 2018.
2	"Understanding Virtual Reality Interface", William R. Sherman and Alan B. Craig, Application, and Design, 2nd Edition, Morgan Kaufmann Publishers, Elsevier, 2019.
3	"Virtual Reality Technology", Grigore C. Burdea, Philippe Coiffet, 2nd Edition, Wiley, 2017.
4	"Handbook on Virtual Environments", K.S. Hale and K. M. Stanney, 2nd Edition, CRC Press, 2015.

Web links and Video Lectures (e – Resources)	
1	https://vr.cs.uiuc.edu/vrbook.pdf
2	https://nptel.ac.in/courses/106/106/106106138/

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3								2	2	3	1
CO2	3				2					2	2	2	3
CO3	3	2	2		1	1	1			2	2	3	2
CO4	3	2	3		2	1	1			2	2	3	2
CO5	3	2	2	1	2	1	1			2	2	2	3

Semester: VII					
Deep Learning					
Course Code	**:**	BIS724C	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming for Problem Solving (C Programming/Python), Data Structures and Applications, Design and Analysis of Algorithms, Probability and Statistics, Linear Algebra and Calculus (Engineering Mathematics
Knowledge on Fundamental Concepts	Basic concepts of Artificial Intelligence and Machine Learning, Mathematical foundations including matrices, vectors, derivatives, gradients, and probability distributions, Fundamentals of Neural Networks (Perceptron, Activation Functions, Feedforward Networks)
Knowledge on Connected Tools (If any)	Python Programming, Jupyter Notebook or Google Colab,NumPy and Pandas for numerical computing and data manipulation, Matplotlib/Seaborn for visualization

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basic concepts of deep learning.
CLO2	Know the basic working model of Convolutional Neural Networks and RNN in decision making).
CLO3	Illustrate the strength and weaknesses of many popular deep learning approaches
CLO4	Apply major deep learning algorithms and techniques to address real-world problems in domains such as computer vision, natural language processing, healthcare, and speech recognition.
CLO5	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

Module – 1	**8 Hrs**

Introducing Deep Learning: Biological and Machine Vision: Biological Vision, Machine Vision: The Neocognitron, LeNet-5, The Traditional Machine Learning Approach, ImageNet and the ILSVRC, AlexNet, TensorFlow Playground. **Human and Machine Language**: Deep Learning for Natural Language Processing: Deep Learning Networks Learn Representations Automatically, Natural Language Processing, A Brief History of Deep Learning for NLP, Computational Representations of Language: One-Hot Representations of Words, Word Vectors, Word-Vector Arithmetic, word2viz, Localist Versus Distributed Representations, Elements of Natural Human Language.

Text book 2: Chapter 1, 2

Module – 2	**8 Hrs**

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi- Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates.

Text book 1 : Ch7: 7.1 -7.10, Ch 8 :8.1,8.3-8.5

Module – 3	**8 Hrs**

Convolution neural networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Convolutional Networks and the History of Deep Learning.

Text book 1: Ch 9 :9.1 -9.8, 9.11

Module – 4	**8 Hrs**

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory.

Text book 1: Ch 10 :10.1 -10.6, 10.10

Module – 5	**8 Hrs**

Interactive Applications of Deep Learning: Natural Language Processing: Preprocessing Natural Language Data: Tokenization, Converting All Characters to Lowercase, Removing Stop Words and Punctuation, Stemming, Handling n-grams, Preprocessing the Full Corpus, Creating Word Embeddings with word2vec: The Essential Theory Behind word2vec, Evaluating Word Vectors, Running word2vec, Plotting Word Vectors, The Area under the ROC Curve: The Confusion Matrix, Calculating the ROC AUC Metric, Natural Language Classification with Familiar Networks: Loading the IMDb Film Reviews, Examining the IMDb Data, Standardizing the Length of the Reviews, Dense Network, Convolutional Networks, Networks Designed for Sequential Data: Recurrent Neural Networks, Long Short-Term Memory Units, Bidirectional LSTMs, Stacked Recurrent Models, Seq2seq and Attention, Transfer Learning in NLP.

Text book 2: Chapter-8

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the concepts of neural networks learning processes.
CO2	Illustrate deep learning methods using regularization and Optimization process
CO3	Design deep learning models using convolutional operations.
CO4	Analyze sequential data to build recurrent and recursive models.
CO5	Demonstrate the different interactive applications of deep learning.

Text Books	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016, ISBN-13: 978-0262035613. https://www.deeplearningbook.org/lecture_slides.html
2	John Krohn, Grant Beyleveld, Aglae Bassens, Deep Learning Illustrated, A Visual, Interactive Guide to Artificial Intelligence, Pearson, 2022, ISBN-13: 9789353945466

Reference Books	
1	Deep Learning Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press,2016, ISBN-10**:** 0262035618
2	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms" Nikhil Buduma O'Reilly publications2010, ISBN-10: 1491925612

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=VyWAvY2CF9c
2	https://www.youtube.com/watch?v=7sB052Pz0sQ
3	https://www.youtube.com/watch?v=Mubj_fqiAv8
4	https://www.coursera.org/learn/neural-networks-deep-learning

CO – PO MAPPING

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

Semester: VII					
Natural Language Processing					
Course Code	**:**	BCS724D	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	AI&ML, Automata Theory
Knowledge on Fundamental Concepts	Grammar, Programming languages, Natural Language
Knowledge on Connected Tools (If any)	NLTK, OpenNLP

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the relationship between language, thought, and understanding in NLP.
CLO2	Compute and smooth N-gram probabilities for language modeling.
CLO3	Use Earley parsing and unification to analyze sentence structures.
CLO4	Implement Hidden Markov Models for sequence labeling tasks.
CLO5	Evaluate information retrieval models and text categorization algorithms.

Module – 1	**08Hrs**
Introduction: Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms; Language, Thought, and Understanding; The State of the Art and The Near Term Future. **Regular Expressions and Automata:** Regular Expressions, Finite state automata, Regular languages and FSAs. **Morphology and Finite-State Transducers:** Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing. **Textbook 1**: **Ch. 2**: 2.4, **Ch. 3**: 3.1 – 3.6	
Module – 2	**08Hrs**
N-grams: Counting Words in Corpora, Smoothing, N-grams for Spelling and Pronunciation, Entropy. **Word Classes and Part-of-Speech Tagging:** Part-of-Speech Tagging, Rule-based Part-of-speech Tagging, Stochastic Part-of-speech Tagging, Transformation-Based Tagging. **Context-Free Grammars for English:** Constituency, Context-Free Rules and Trees, Sentence-Level Constructions, The Noun Phrase. **Textbook 1**: **Ch. 5:** 5.1 – 5.5 **Textbook 2**: **Ch. 4:** 4.1 – 4.3	
Module – 3	**08Hrs**
Parsing with Context-Free Grammars: Parsing as search, The Earley Algorithm. **Features and Unification:** Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints. **Lexicalized and Probabilistic Parsing:** Probabilistic Context-Free Grammars, Problems with PCFGs. **Textbook 1**: **Ch. 11:** 11.1 – 11.3 **Textbook 2**: **Ch. 5:** 5.1 – 5.5	
Module – 4	**08Hrs**

Markov Models: Hidden Markov Models, The three fundamental questions for HMMs, HMMs: Implementation, Properties, and variants.

Statistical Alignment and Machine Translation: Text Alignment, Word Alignment, Statistical Machine Translation.
Textbook 1: Ch. 24: 24.1 – 24.6
Textbook 2: **Ch. 8:** 8.1 – 8.5

Module – 5	**08Hrs**

Information Retrieval: Vector space model, term weighting, term selection and creation, homonymy, polysemy, synonym, improving user queries.
Text Categorization: Decision Trees, Maximum Entropy Modeling, Perceptron's, k Nearest Neighbor Classification.
Textbook 1: **Ch. 26:** 26.1 – 26.4, 26.8, **Ch. 28**: 28.1 – 28.3

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret fundamental concepts of natural language processing, including language modeling, morphology, and parsing techniques.
CO2	Apply statistical and rule-based methods for part-of-speech tagging and language modeling.
CO3	Analyze parsing algorithms and grammar frameworks for syntactic analysis of language.
CO4	Implement machine learning models such as Hidden Markov Models and statistical machine translation techniques.
CO5	Evaluate techniques for information retrieval and text categorization using vector space models and classification algorithms.

Textbooks	
1	"Speech and Language Processing: An introduction to Natural Language Processing", Computational Linguistics and Speech Recognition. Daniel Jurafsky and James H Martin Prentice Hall 2nd Edition, 2023.
2	"Foundations of Statistical Natural Language Processing", Christopher D. Manning MIT Press 1st Edition, 1999.

Reference Books	
1	"Natural language processing with Python", Bird Steven, Ewan Klein, and Edward Loper O'Reilly Media, Inc. 1st Edition, 2009
2	"Natural Language Processing and Information Retrieval", Tanveer Siddiqui, U.S. Tiwary Oxford University Press 2008
3	"Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python", Akshay Kulkarni and Adarsha Shivananda, Apress, 2019

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106105158
2	https://www.youtube.com/watch?v=M7SWr5xObkA
3	https://youtu.be/02QWRAhGc7g
4	https://www.youtube.com/watch?v=CMrHM8a3hqw
5	https://onlinecourses.nptel.ac.in/noc23_cs45/preview

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3						1			1	2	2
CO2	3	3						1			1	3	2
CO3	3	3	2					1			1	2	2
CO4	2	2	2					1			1	3	3
CO5	2	2	2					1			1	3	3

Semester: VII					
Introduction to Database Management System					
Course Code	**:**	BCS745A	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming in C/Python, Mathematics, Data Structures, Discrete Mathematics
Knowledge on Fundamental Concepts	Basic Programming Knowledge, Arrays, Set Operations, Access Methods.
Knowledge on Connected Tools (If any)	MySQL, PostgreSQL, SQLite, Microsoft SQL Server, Oracle Database

Course Learning Objectives: This course will enable the students to	
CLO1	Comprehend the basic concepts and definitions of databases and database users, including their roles in a database system.
CLO2	Construct ER diagrams using real-world scenarios to model data requirements.
CLO3	Develop and manipulate relational databases using SQL.
CLO4	Design efficient relational schemas using normalization and functional dependencies.
CLO5	Understand and apply transaction processing, concurrency control, and recovery mechanisms in databases.

Module – 1	**08Hrs**
Introduction to Databases and database users: Introduction to DBMS, Characteristics of the Database Approach, Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment **Textbook 1:Ch. 1:** 1.1 – 1.6, **Ch. 2:** 2.1 to 2.4	
Module – 2	**08Hrs**
Data Modeling Using the Entity–Relationship (ER) Model : A Sample Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions **Relational Algebra:** Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra. **Textbook 1: Ch. 3:** 3.1 to 3.7, **Ch. 8:** 8.1 to 8.5	
Module – 3	**08Hrs**
Basic Structured Query Language (SQL): SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Basic Queries in SQL; Insert, Delete and Update Statements in SQL; Schema Change Statements in SQL; Aggregate Functions and GROUP BY; Joins in SQL, Views (Virtual Tables) in SQL. **Textbook 1: Ch. 6:** 6.1 to 6.4, **Ch. 7:** 7.3 to 7.4	
Module – 4	**08Hrs**

Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form **Textbook 1: Ch. 14:** 14.1 to 14.7
Module – 5 **08Hrs**
Introduction to Transaction Processing Concepts and Theory: Introduction to transaction processing; transaction and system concepts; desirable properties of transactions, transaction support in SQL **Concurrency Control & Database Recovery Techniques:** Two phase locking techniques, Concurrency control based on Timestamp ordering; Recovery concepts; NO-UNDO/REDO Recovery Based on Deferred Update **Textbook 1: Ch. 20:** 20.1 to 20.3,20.6 **Ch. 21:** 21.1 – 21.2, **Ch. 22:** 21.1 to 22.2

Course Outcomes: After completing the course, the students will be able to	
CO1	Articulate the core concepts of DBMS including data models, architecture, and database languages.
CO2	Apply ER modeling and relational algebra to represent and manipulate real-world data.
CO3	Apply SQL to create schemas, manipulate data, enforce constraints, perform joins and aggregation, and implement views in relational databases.
CO4	Design efficient relational schemas by applying normalization techniques, functional dependencies, and decomposition principles to reduce redundancy and maintain data integrity.
CO5	Develop reliable databases by analyzing transaction management, concurrency control, and recovery techniques.

Textbook	
1	"Fundamentals of Database Systems", Elmasri and Navathe Pearson Education, 7th,Edition,2017, ISBN-13: 978-0-13-397077-7

Reference Books	
1	"Database System Concepts", Silberschatz, Korth and Sudharshan. McGraw-Hill 6th Edition,2016, ISBN 978-0-07-352332-3
2	"Database Management Systems", Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill. 3rd Edition, 2003, ISBN-13: 9780072465631

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
2	https://www.youtube.com/watch?v=sEaYXwmsLw0&list=PLyqSpQzTE6MxymXgqewlzcC3U4cdRoSu
3	https://www.w3schools.com/sql/default.asp

CO – PO – PSO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2					1		1		2	1	1
CO2	3	2	3		2		1		1	1	2	1	1
CO3	2	3	2		3		1		1	1	2	1	1
CO4	3	3	2		2		1		1	1	2	1	1
CO5	3	3	2	2	3		1		1	1	2	1	1

Semester: VII					
Introduction to Algorithms					
Course Code	**:**	BCS745B	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming Fundamentals, Mathematics
Knowledge on Fundamental Concepts	Arrays, Strings, Structures, Pointers
Knowledge on Connected Tools (If any)	GCC, Code Blocks

Course Learning Objectives: This course will enable the students to	
CLO1	Understand algorithm design principles and analyze algorithm performance using asymptotic notations.
CLO2	Apply brute-force and divide-and-conquer techniques to solve sorting and searching problems.
CLO3	Utilize decrease-and-conquer, transform-and-conquer, and space-time tradeoff techniques for efficient problem solving.
CLO4	Apply dynamic programming and greedy methods to solve optimization and graph problems
CLO5	Explore computational complexity concepts and utilize backtracking and branch-and-bound methods for solving combinatorial problems.

Module – 1	**08Hrs**
Introduction: What is an Algorithm? Fundamentals of Algorithmic Problem Solving. **Fundamentals of the Analysis of Algorithm Efficiency:** Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Textbook 1: Ch 1:** 1.1-1.2**, Ch 2:** 2.1- 2.4	
Module – 2	**08Hrs**
Brute Force: Selection Sort, Bubble sort, Sequential Search and Brute-Force String Matching **Divide and Conquer:** Merge sort, Quick sort. **Textbook 1: Ch 3:** 3.1-3.2, **Ch 5:** 5.1,5.2,	
Module – 3	**08Hrs**
Decrease-and-Conquer: Insertion Sort, Topological Sorting. Decrease-by-a-Constant-Factor Algorithm: Binary Search. **Transform-and-Conquer:** Balanced Search Trees, Heaps and Heapsort. **Space-Time Tradeoffs:** Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm. **Textbook 1: Ch 4:** 4.1,4.2,4.4, **Ch 6:** 6.3,6.4**, Ch 7:** 7.1,7.2	
Module – 4	**08Hrs**
Dynamic Programming: Warshall's and Floyd's Algorithms, Knapsack Problem. **Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes. **Textbook 1: Ch 8:** 8.2,8.4 **Ch 9:** 9.1-9.4	

Module – 5	08Hrs
Limitations of Algorithmic Power: Decision Trees: Comparison of three variables, Selection Sort, P, NP, and NP-Complete Problems. **Coping With Limitations of Algorithmic Power:** Backtracking: n-Queens problem, Subset-sum problem, Branch-and-Bound: Knapsack problem. **Textbook 1: Ch 11:** 11.2,11.3, **Ch 12:** 12.1,12.2	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret algorithmic problem-solving concepts and analyze algorithm performance using asymptotic analysis.
CO2	Apply brute-force and divide-and-conquer strategies to solve sorting and searching problems.
CO3	Utilize decrease-and-conquer, transform-and-conquer, and space-time tradeoff techniques in algorithm design.
CO4	Apply dynamic programming and greedy techniques to solve optimization problems.
CO5	Analyze computational complexity and apply backtracking and branch-and-bound methods to solve combinatorial problems.

Textbook	
1	"Introduction to the Design and Analysis of Algorithms", Anany Levitin, 3rd Edition (Indian), 2021, Pearson, ISBN-13: 978-0137541133.

Reference Books	
1	"Computer Algorithms/C++", Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press, ISBN-13: 978-8173716119.
2	"Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, PHI 4th Edition 2022, ISBN 978-0-262-03384-8.
3	"Design and Analysis of Algorithms", S. Sridhar, Oxford (Higher Education), 2nd Edition, 2023, ISBN-13: 978-9354977886.

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc23_cs88/preview
2	https://www.geeksforgeeks.org/introduction-to-algorithms/
3	https://www.naukri.com/code360/library/types-of-algorithms-and-their-uses
4	https://topperworld.in/daa-tutorial-2/
5	https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O

CO – PO – PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-					1	1	3	1
CO2	3	3	3	2	1					1	1	3	3
CO3	3	3	2	2	1					1	1	3	2
CO4	3	3	3	2	2					1	1	2	3
CO5	3	3	2	3	2					1	2	2	2

Semester VII					
Software Engineering					
Course Code	**:**	BIS745C	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming Fundamentals, Database Structures, Object Oriented Programming with C++
Knowledge on Fundamental Concepts	Software Development Life Cycle (SDLC), Modularity and Reusability, Basic UML Diagrams
Knowledge on Connected Tools (If any)	IDS, GCC

Course Learning Objectives: This course will enable the students to	
CLO1	Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issue.
CLO2	Distinguish between various software process models and apply them to real-world scenarios.
CLO3	Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams
CLO4	Discuss various types of software testing practices and software evolution processes
CLO5	Recognize the importance of Project Management with its methods and methodologies

Module – 1	**08 Hrs**
Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. **Software Processes:** Models: Waterfall Model, Incremental Model and Spiral Model Process activities. **Requirements Engineering:** Requirements Engineering Processes, Requirements Elicitation and Analysis, Functional and non-functional requirements, The software Requirements Document, Requirements Specification Requirements validation, Requirements Management. **Textbook 1: Ch1, Ch 2, Ch 4**	
Module – 2	**08 Hrs**
Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. **Modelling as a Design technique:** Modelling; Abstraction; The Three models. **Class Modelling:** Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models. **Textbook 2: Ch 1 - 1.1-1.5, Ch 2 - 2.1-2.3 and Ch 3 - 3.1-3.5**	
Module – 3	**08 Hrs**
System Models: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering, **Design and Implementation:** Object-oriented design using the UML, Design patterns, Implementation issues, Open source development **Textbook 1: Ch 5, Ch 7**	

Module – 4	08 Hrs
Software Testing: Development testing, Test-driven development, Release testing, User testing. **Software Evolution:** Evolution processes, Program evolution dynamics, Software maintenance, Legacy system management **Textbook 1 : Ch 8, Ch 9**	
Module – 5	**08 Hrs**
Project Planning: Software pricing, Plan-driven development, Project scheduling, Agile Planning. Estimation techniques. **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement and metrics **Textbook 1: Ch 23, Ch 24**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Examine the importance of ethics and professionalism in software engineering
CO2	Utilize software engineering techniques to create software components that address specified requirements.
CO3	Evaluate the suitability of object-oriented models and UML diagrams for representing different software system requirements.
CO4	Analyze software testing strategies and software evolution processes to improve software reliability and performance.
CO5	Examine project planning, scheduling, and resource management techniques to support successful project execution.

Text Books	
1	Software Engineering, Ian Sommerville, 9th Edition, 2012, Pearson Education, ISBN-13: 978-0-13-703515-1 ISBN-10: 0-13-703515-2
2	Michael Blaha and James Rumbaugh, *Object-Oriented Modeling and Design with UML*, 2nd Edition, Pearson Education, 2012 (Updated Edition), ISBN-13: 978-0133002171

Reference Books	
1	Software Engineering-A Practitioners approach, Roger S. Pressman, 7th Edition, 2010, Global Publisher, ISBN 978-0-07-337597-7
2	An Integrated Approach to Software Engineering, Pankaj Jalote, 3rd Edition, 2005, Wiley India, ISBN-10: 0-387-28132-0 (eBook)

Web links and Video Lectures (e – Resources)	
1	https://archive.nptel.ac.in/courses/106/101/106101061/
2	https://archive.nptel.ac.in/courses/106/105/106105182/

CO – PO MAPPING

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

Semester: VII					
Web Technologies					
Course Code	**:**	BIS745D	**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	OEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to Programming, Problem Solving and Algorithms
Knowledge on Fundamental Concepts	Computer Basics, Basic Logic Building, Text Editing Tools, Web and Internet Basics
Knowledge on Connected Tools (If any)	XAMPP/WAMP, Visual Studio Code, Notepad++

Course Level Objectives: Student able to	
CLO1	Understand web programming fundamentals, HTTP, security, and HTML structure.
CLO2	Illustrate HTML and XHTML syntax, structure, elements, and differences.
CLO3	Design web pages using CSS for styling, layout, and structure.
CLO4	Apply JavaScript and DOM techniques to manipulate web page elements and handle user interactions.
CLO5	Design server-side applications using PHP and web server functionalities.

Module 1	**8 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. **Textbook 1:** Ch 1 :1.1 to 1.8	
Module 2	**8 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. **Textbook 1:** Ch 2: 2.1 to 2.10	
Module 3	**8 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. **Textbook 1:** Ch 3: 3.1 to 3.12	
Module 4	**8 Hrs**
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.	

Textbook 2: Ch 6: 6.1 to 6.7

Module 5	**8 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 Super globals: Arrays, $_GET and $_POST Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files.

Textbook 2: Ch 8: 8.1 to 8.5, Ch 9: 9.1 to 9.5

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

Textbooks	
1	"Programming the World Wide Web", Robert W Sebesta, 6th Edition, Pearson Education, 2022. ISBN: 978-0137618149
2	"Fundamentals of Web Development", Randy Connolly and Ricardo Hoar, 3rd Edition, Pearson, 2022. ISBN: 978-0135863336

Reference Books	
1	"Internet & World Wide Web How to program", M.Deitel, P.J.Deitel, A.B.Goldberg, 3rd Edition, Pearson Education / PHI, 2004. ISBN: 978-0131450912
2	"Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5", Robin Nixon, 4th Edition, O"Reilly Publications, 2015. ISBN:978-9352130153
3	"PHP and MySQL Web Development", Luke Welling, Laura Thomson, 5th Edition, Pearson Education, 2016. ISBN:978-9332582736
4	"Professional JavaScript for Web Developers", Nicholas C Zakas, 3rd Edition, Wrox/Wiley India, 2012. 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

CO – PO MAPPING

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

Semester: VII					
Major Project Phase – II					
Course Code	**:**	BCS736	**Credits**	**:**	6
Hours/Week(L:T:P)	**:**	0:0:12	**CIE**	**:**	100
Total Hours	**:**	36 Hrs	**SEE**	**:**	100
Course Type	**:**	PROJ	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming with C, Python, Software Engineering, Data Structures and Algorithms, Web Development
Knowledge on Fundamental Concepts	Coding skills, SDLC
Knowledge on Connected Tools (If any)	Eclipse, Edit plus, GCC, Codeblocksy, Visual Studio

Course Outcomes: After completing the course, the students will be able to	
CO1	Design an engineering solution to address the identified problem.
CO2	Implement the proposed solution using appropriate tools and technologies.
CO3	Evaluate the functionality and reliability of the developed solution through systematic testing.
CO4	Interpret test results to evaluate the developed solution against project objectives.
CO5	Demonstrate professional skills through teamwork, technical documentation, and project presentation.

PROJECT WORK (BCS636): The objective of the Project work is
(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instil responsibilities to oneself and others.
(viii)To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:
(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(**2) Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college.
Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3		2		1				1	3	2
CO2	3	2	3	1	3						2	3	2
CO3	2	3	2	3	2						1	3	1
CO4	2	3	1	3	2					1		2	2
CO5								2	3	3	2	1	3

Semester: VII					
Career Readiness and Industry Integration					
Course Code	**:**	BCR707	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:2:0	**CIE**	**:**	100 Marks
Total Hours	**:**	60Hrs	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Competency Enhancement Course-1,2,3&4
Knowledge on Fundamental Concepts	-
Knowledge on Connected Tools	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Strengthen core aptitude and reasoning skills
CLO2	Build confidence and competence for interviews and group activities
CLO3	Develop foundational and advanced problem-solving using Data Structures and Algorithms (DSA)
CLO4	Enable algorithmic thinking through pseudocode
CLO5	Apply clean coding practices in high-pressure environments

Module – 1	**12 Hrs**
Company-Specific Aptitude Practice Solve previous year question papers from major campus recruiters. These detailed solutions help candidates familiarize themselves with the patterns, difficulty levels, and frequently asked question types of leading companies. **Textbook1, Ch1-7, Textbook 2, Ch1-5**	
Module – 2	**12 Hrs**
Group Discussion Mastery Revisiting key principles of effective GDs, Abstract, current affairs, and case-based topics, Role of initiator, moderator, and conclusion leads, Multiple GD rounds with evaluation rubrics, How to stand out without dominating **Resume Writing and Linked Profiling** Effective resume writing involves a clear, results-focused format tailored to the job, highlighting key skills and quantified achievements. A strong LinkedIn profile complements this by showcasing your professional story, skills, endorsements, and active engagement to boost visibility and credibility. **Interview Skills** Quick recap of HR & Technical Interview structures, Smart resume revision techniques Rebuilding your personal pitch for 2025 placements, Mock Q&A: Handling common & tricky questions, Feedback loops for voice tone, articulation & clarity **Mock Interviews (Technical + HR) Practice Rounds** Individual interview rounds in real-time simulation, Panel-style questioning and cross-questioning, Focused feedback on confidence, grooming, and articulation, Personalized correction pointers for improvement **Textbook -3, Page-1-112**	
Module-3	**12 Hrs**

Importance of Competitive Coding for interviews and placements Problem decomposition & edge case identification, Basics of time and space complexity, Story-based introduction to problem-solving, Brainstorm real-world scenarios & translate to problems, Identify edge cases via mini-quizzes, Live walkthroughs (e.g., parking fee calculator), **Coding warm-up challenge** Arrays, Linked Lists, Stacks, Queues, Hashing, Trees, Graphs, Mapping DS to real-life systems (e.g., ticket booking, social feeds), Trade-offs in DS selection, Implement DS in hands-on coding labs, Real-life simulation: Airline or hospital queue system, Use case discussions, Group exercises with efficiency comparisons, Greedy, Divide & Conquer, DP, Backtracking, Practical applications with real-world stories, Efficiency and trade-offs, Debugging complex logic, Group challenge: Route optimization using Dijkstra, Hands-on: Knapsack, Fibonacci DP, Game simulations, Compare multiple approaches for the same problem, Debugging hackathons **Reference Book 1-Ch1-12**

Module-4	**12 Hrs**
Importance of pseudocode in problem-solving and interview prep Structure and syntax of pseudocode (input/output, conditionals, loops), Translating problem statements into structured pseudocode, Converting pseudocode to actual code (dry run), Common logical mistakes in pseudocode, Aligning pseudocode with data structure & algorithm design, Write pseudocode for classic problems (e.g., factorial, palindrome, searching/sorting), Group activity: Convert real-world scenarios into pseudocode (e.g., ATM simulation, elevator logic), Peer reviews and correction of pseudocode, Dry-run pseudocode vs actual code, Challenge: Write pseudocode for unseen story-based problems **Reference Book 2-Ch1-5**	
Module-5	**12 Hrs**
Real-time coding practice under pressure Clean code and edge case handling, Explaining solutions during interviews, Final review of optimization strategies, Mock interviews with peer & trainer feedback, Solve end-to-end coding case studies, Debugging marathons, Individual reflection + feedback loop **Reference Book 3-Ch1-6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply foundational aptitude concepts to solve quantitative, verbal and logical reasoning problems with accuracy and efficiency.
CO2	Demonstrate professional communication skills and interview readiness through mock interviews, personal pitch delivery and group discussions.
CO3	Solve coding problems using appropriate data structures and algorithms, recognizing edge cases and optimizing for time/space complexity.
CO4	Interpret real-world problems into structured pseudocode and implement clean, logical solutions in code.
CO5	Perform under interview-like coding conditions, explain approaches and apply debugging techniques to deliver optimal solutions.

Text Books	
1	**Quantitative Aptitude for Competitive Examinations,** R.S. Aggarwal Chand Publishing. – 2023.
2	**Objective English,** S.P. Bakshi, 3rd Edition, Arihant Publications – 2021, ISBN-978-9325791718
3	**Cracking the Code to a Successful Interview,** Evan Pellett, Blackstone Pub- 2016, ISBN- 978-1441700537

Reference Books	
1	**Data Structures and Algorithms,** Narasimha Karumanchi, 5th Edition, Careermonk Publications – 2016, ISBN- 978-8193245279
2	**Algorithm Design Manual,** Steven Skiena, 1st Edition, SPRINGER NP EXCLUSIVE(CBS)- 2017, ISBN- 978-1849967204
3	**Cracking the Coding Interview,** Gayle Laakmann McDowell, 6th Edition, CareerCup-2015, ISBN- 978-0984782857

Web links and Video Lectures (e – Resources)	
1	https://www.placementpreparation.io/quantitative-aptitude/
2	https://www.examsnet.com/quantitative-aptitude
3	https://www.testmocks.com/blog/reasoning-mock-test/
4	https://www.practice4me.com/verbal-ability-test/
5	https://codersdaily.in/start/verbal-aptitude-test
6	https://grow.google/certificates/interview-warmup/
7	https://course.flourish.careers/interview-essentials-toolkit
8	https://gdpiwat.com/gd-concepts/
9	https://timespro.com/online-courses/certificate-program-in-professional-grooming-and-workplace-behaviour
10	https://www.edstellar.com/course/grooming-etiquette-training
11	https://www.hackerrank.com/
12	https://www.codechef.com/practice
13	https://codeforces.com/blog/entry/23054
14	https://algocademy.com/blog/how-to-write-pseudocode-that-impresses-interviewers/
15	https://algocademy.com/blog/how-to-use-pseudocode-effectively-in-technical-interviews-a-comprehensive-guide/
16	https://codeforces.com/
17	https://leetcode.com/

CO – PO MAPPING

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

SJC INSTITUTE OF 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. – CSE

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

8th Semester

Computer Science and Engineering												
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**				
					L	**T**	**P**	**SEE Duration (Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BCS821x	Professional Elective Course - V (Online Course) only through NPTEL / VTU MOOC / Centre Of Excellence of the concerned department	PEC		3	0	0	**3**	**50**	**50**	**100**	**3**
2	BCS842x	Open Elective Course - III (Online Course) only through NPTEL / VTU MOOC / Centre Of Excellence of the concerned department	OEC		3	0	0	**3**	**50**	**50**	**100**	**3**
3	BCS833	Internship (Industry / Research / Rural) (14 – 20 weeks)	INT		0	0	12	**3**	**100**	**100**	**200**	**8**
									200	**200**	**400**	**14**

PEC: Professional Elective Course, OEC: Open Elective Course, INT: Industry Internship / Research Internship, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Professional Elective Course – V (Online Course – only through NPTEL, suggested by BoS)

Course Code	Course Name	Course Code	Course Name
BCS821A	Ethical Hacking	BCS821C	Introduction to Large Language Models
BCS821B	Soft Computing	BCS821D	Human Computer Interaction

Open Elective Course – III (Online Course – only through NPTEL, suggested by BoS)

Course Code	Course Name	Course Code	Course Name
BCS842A	Machine Learning for Engineering and Science Applications	BCS842C	Cyber Security

BCS842B	Programming in Java	BCS842D	Cloud computing

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Elucidation: At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

Credit Definition

1-hour Lecture (L) per week=1Credit	04-Credits courses are to be designed for 50 hours of Teaching-Learning Session
2-hoursTutorial(T) per week=1Credit	04-Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions
2-hours Practical / Drawing (P) per week=1Credit	03-Credits courses are to be designed for 40 hours of Teaching-Learning Session
2-hous Skill Development Actives (SDA) per week = 1 Credit	02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
	01-Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Semester: VIII					
Internship					
Course Code	**:**	BCS833	**Credits**	**:**	8
Hours/Week(L:T:P)	**:**	0:0:12	**CIE**	**:**	100 Marks
Total Hours	**:**	100Hrs	**SEE**	**:**	100 Marks
Course Type	**:**	INT	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Programming with C, Data Structures and Applications, Database Management Systems, Operating Systems, Computer Networks, Software Engineering.
Knowledge on Fundamental Concepts	Basic understanding of programming, problem-solving, algorithms, software development life cycle, debugging techniques, communication skills, and professional ethics.
Knowledge on Connected Tools (If any)	Familiarity with programming IDEs (Visual Studio Code, Eclipse, IntelliJ IDEA, or PyCharm), version control tools (Git/GitHub), office productivity tools, online collaboration platforms and domain-specific tools/software as required by the internship organization.

Course Learning Objectives: This course will enable the students to	
CLO1	Develop employability skills, professional attributes, and an understanding of organizational practices.
CLO2	Apply engineering knowledge and modern tools to solve real-world engineering problems.
CLO3	Strengthen professional competencies through the application of theory to practice.
CLO4	Demonstrate communication, teamwork, leadership, ethics, and lifelong learning skills.
CLO5	Gain workplace exposure and reflect on professional experiences for career development.

Internship Guidelines(14 to 20 weeks):

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

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Course Outcomes: After completing the Internship, the students will be able to	
CO1	Demonstrate professional competency through communication, teamwork, leadership, and ethical practices.
CO2	Apply engineering knowledge, technical skills, and modern tools to solve real-world engineering problems.
CO3	Analyze organizational practices, work processes, and professional ethics in research, industrial, or rural environments.
CO4	Evaluate alternative technical solutions considering practical, economic, and societal constraints.
CO5	Develop an internship report and present technical outcomes professionally.

CO – PO – PSO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1								3	3	3	2	2	2
CO2	3	3	2	2	3							3	3
CO3	2	3				2	1	3	2	2	1	2	2
CO4	2	3	3	2	3	2	2	2	2		2	3	3
CO5									2	3	1	1	1

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

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

Department Vision

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

Department Mission

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

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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