

Course Structure of
Bachelor of Technology (B. Tech)
in
Computer Science and Engineering
(CSE)

Academic Year 2025-2026



Birla School of Engineering & Technology
Birla Global University
Bhubaneswar

Contents

1	Vision	1
2	Mission	1
3	Objectives of Program	1
4	Description of the Programme	2
5	Graduate Attributes	3
6	Program Outcomes (POs)	4
7	Programme Specific Outcomes (PSOs)	6
8	Programme Educational Objectives (PEOs)	6
9	Outcome Based Education (OBE)	6
10	Syllabus Structure	8
11	Detailed Syllabus	14

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Vision

To be a leading school in computer science and engineering, fostering global knowledge, innovation, and ethical practices to address the challenges of a technology-driven world.

Mission

1. To cultivate technical excellence and innovation through an experiential learning environment, integrating real-world problem-solving to prepare students for global challenges.
2. To offer a flexible curriculum with diverse electives, empowering students to tailor their education and develop multidisciplinary competencies.
3. To nurture industry readiness by providing skill enhancement programs, technical training, and career support aligned with emerging trends in computer science and engineering.
4. To build industry-academia collaborations, exposing students to state-of-the-art practices, promoting sustainable innovation, and fostering a culture of inclusiveness and lifelong learning.

Objectives of the Program

The objective this program is to prepare students for a successful career in engineering, research, or academia. The program aims to develop students' problem-solving skills and prepare them for the needs of the industry.

1. Comprehensive Technical Knowledge

To ensure students acquire a strong foundation in computer science concepts, theories, and applications, enabling them to solve complex technical problems effectively.

2. Research and Innovation

To develop students' ability to conduct research, innovate, and adapt to rapidly evolving technologies, fostering a culture of inquiry and continuous improvement.

3. Ethical and Professional Conduct

To instil professional ethics, integrity, and social responsibility, preparing students to make informed and ethical decisions in their professional careers.

4. Lifelong Learning

To encourage a mind-set of lifelong learning and adaptability, equipping students to stay updated with the latest trends and advancements in computer science and engineering.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

5. Global and Cross-Disciplinary Competence

To prepare students to work effectively in diverse and interdisciplinary teams, ensuring they are capable of addressing global challenges with innovative solutions.

6. Problem-Solving and Critical Thinking

To cultivate critical thinking and analytical skills for designing, implementing, and optimizing computing systems and applications to solve real-world problems.

7. Leadership and Teamwork

To develop leadership qualities and the ability to work collaboratively, empowering students to lead and contribute to projects and initiatives in dynamic, global industries.

8. Social Responsibility and Sustainability

To nurture awareness of societal and environmental needs, encouraging students to create solutions that contribute positively to sustainable development.

9. Entrepreneurship and Industry Readiness

To equip students with entrepreneurial abilities and industry-relevant skills, preparing them for roles in start-ups, established organizations, and as innovators.

10. Specialized Expertise

To provide opportunities for specialization in areas such as artificial intelligence, machine learning, cloud computing, data science, cybersecurity, and the Internet of Things, aligning with contemporary industry demands.

B.Tech in Computer Science & Engineering

The Bachelor of Technology (B.Tech) in Computer Science & Engineering is a four-year undergraduate program designed to provide students with a comprehensive understanding of computer science principles, software development, and modern technologies. The program emphasizes both theoretical foundations and practical skills to prepare students for successful careers in the rapidly evolving tech industry.

Throughout the course, students gain expertise in areas such as programming, algorithms, data structures, artificial intelligence, machine learning, cloud computing, cybersecurity, software engineering, and more. The curriculum is designed to align with industry needs, equipping students with the knowledge to tackle real-world challenges through innovative problem-solving and cutting-edge technological solutions.

In addition to technical proficiency, the program also focuses on developing essential skills such as critical thinking, teamwork, communication, and leadership. Students are encouraged to engage in research and innovation, fostering a mindset of lifelong learning and adaptability.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Graduates of the B.Tech in Computer Science & Engineering program are prepared for a wide range of career opportunities in software development, IT consulting, data science, cybersecurity, and beyond. The program also equips students with the entrepreneurial skills to pursue startups or contribute to interdisciplinary teams, making them highly adaptable in a fast-paced, global job market.

Overall, the B.Tech in Computer Science & Engineering program aims to produce well-rounded, ethically responsible professionals who are capable of contributing meaningfully to technological advancements and societal development

Graduate Attributes

The B.Tech in Computer Science & Engineering program is designed to develop the following key graduate attributes, ensuring that students are well-prepared for the demands of the industry and society. The B.Tech program is not only technically proficient but also capable of leading in the dynamic, fast-evolving tech industry while making a positive contribution to society with the following attributes -

1. Technical Expertise

Graduates will have a strong understanding of computer science principles, algorithms, programming languages, and technologies, enabling them to develop, analyse, and optimize software and computing systems.

2. Critical Thinking and Problem-Solving Skills

Graduates will possess the ability to apply logical reasoning and critical thinking to solve complex computational problems, both independently and in collaborative settings.

3. Innovation and Research Orientation

Graduates will be equipped with skills to engage in research and innovation, using modern tools and technologies to create novel solutions and contribute to advancements in the field.

4. Ethical and Social Responsibility

Graduates will demonstrate a high standard of professional ethics and responsibility, ensuring their work positively impacts society, respects cultural diversity, and adheres to legal and environmental standards.

5. Leadership and Teamwork

Graduates will be able to work effectively in interdisciplinary teams and demonstrate leadership abilities, contributing to project planning, execution, and decision-making processes in dynamic and diverse environments.

6. Adaptability and Lifelong Learning

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Graduates will be equipped with the skills to adapt to rapidly evolving technologies, fostering a mind-set of lifelong learning to stay updated with industry trends and pursue continuous professional development.

7. Communication and Interpersonal Skills

Graduates will possess strong communication skills, both written and oral, enabling them to effectively present technical concepts, collaborate with stakeholders, and articulate ideas to diverse audiences.

8. Global Competence

Graduates will be prepared to work in a global context, understanding the implications of technology on international markets and collaborating across borders to develop solutions to global challenges.

9. Entrepreneurial Mind-set

Graduates will have an entrepreneurial outlook, capable of identifying opportunities, innovating, and potentially launching their own ventures or contributing to the success of technology-driven businesses.

10. Sustainability and Environmental Awareness

Graduates will understand the impact of technology on the environment and society, ensuring their solutions promote sustainability and align with global efforts towards social, economic, and environmental well-being.

Program Outcomes (POs)

PO1 Engineering Knowledge

Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2 Problem Analysis

Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3 Design/Development of Solutions

Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4 Conduct Investigations of Complex Problems

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

PO5 Engineering Tool Usage

Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6 The Engineer and The World

Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7 Environment and Sustainability

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics

Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO9 Individual and Collaborative Team work

Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO10 Communication

Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO11 Project Management and Finance

Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO12 Life-Long Learning

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Program Educational Objectives (PEOs)

PEO 1: Graduates will acquire a robust foundation in computer science, enabling them to apply theoretical and practical knowledge to design innovative solutions for real-world problems across diverse industries.

PEO 2: Graduates will demonstrate excellent communication skills, the ability to work collaboratively in multidisciplinary teams, and the adaptability to embrace emerging technologies and dynamic professional environments.

PEO 3: Graduates will exhibit a strong commitment to ethical practices, social responsibility, and sustainable development, contributing positively to society and fostering technological advancements for the greater good.

Program Specific Outcomes (PSOs)

PSO 1: Upon completion of the program, students will demonstrate proficiency in software development by designing, developing, and deploying scalable and reliable software solutions to address real-world problems and meet user requirements effectively.

PSO 2: Graduates will exhibit competence in data analysis and decision making by applying statistical methods, machine learning algorithms, and data visualization techniques to analyze large datasets, extract meaningful insights, and make informed decisions across various domains and industries.

PSO 3: Students will achieve mastery of emerging technologies by acquiring in-depth knowledge and practical experience in areas such as artificial intelligence, machine learning, cloud computing, cybersecurity, and mobile applications, enabling them to adapt to technological advancements and contribute innovatively to the digital transformation of organizations and society.

Outcome Based Approach to Education (OBE)

As per the National Higher Education Qualification Frameworks (NHEQF), students are expected to possess the quality & characteristics of the graduate of a Programme of the study, including learning outcomes relating to the disciplinary areas, learning generic outcomes that are expected to be acquired by a graduate on completion of the Programme.

OBE is an educational model that forms the base of a quality education system. There is no specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set goals. The faculty may adapt the role of an instructor, trainer, facilitator, and/or mentor based on the outcomes targeted. OBE enhances the traditional methods and focuses on what the institute provides to the students. It shows the success by making or demonstrating outcomes using statements 'able to do' in favour of students. It provides clear standards for observable and measurable outcomes.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Credit Distribution and Course Types

Semester	HS	BS	ES	PC	PE	OE	PST	MC	
Sem I	6	4	8					1	19
Sem II	3	7	6	4					20
Sem III	1		4	15			1		21
Sem IV			4	14	3		1		22
Sem V	2			14	3		3	1	23
Sem VI			3	11	3	3	2	1	23
Sem VII	3			8	3	3	4		21
Sem VIII					6	3	6		15
Total Credit	15	11	25	65	15	12	17	3	164
Percentage of the Course	9.1%	6.7%	15.2%	40.2%	10.9%	5.4%	10.3%	1.8%	

HS – Human Science

BS – Basic Science

ES – Engineering Science

PC – Professional Core

PE – Professional Elective

OE – Open Elective

PST – Project/Seminar/Internship

MC – Mandatory Course

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Syllabus Structure

I Semester [First Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-1001	Programming for Problem Solving using C	3	0	0	3
2	CSET-1002	Engineering Mathematics-I	3	1	0	4
3	CSET-1003	Basic Electrical Engineering	3	0	0	3
4	CSET-1004	Universal Human Values	3	0	0	3
5	CSET-1005	French Language	3	0	0	3
6	CSEL-1006	Sports/Yoga	0	0	2	1
7	CSEL-1001	Problem Solving using C Lab	0	0	2	1
8	CSEL-1003	Basic Electrical Engineering Lab	0	0	2	1
TOTAL			19			

II Semester [First Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-2001	Data Structures	3	0	0	3
2	CSET-2002	Engineering Mathematics-II	3	1	0	4
3	CSET-2003	Basic Electronics	3	0	0	3
4	CSET-2004	Engineering Physics	3	0	0	3
5	CSET-2005	Corporate Communications	2	0	0	2
6	CSET-2006	Design Thinking	2	0	0	2
7	CSEL-2001	Data Structure Lab	0	0	2	1
8	CSEL-2003	Basic Electronics Lab	0	0	2	1
9	CSEL-2004	Corporate Communication Lab	0	0	2	1
TOTAL			20			

B.TECH IN COMPUTER SCIENCE & ENGINEERING

III Semester [Second Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-3001	Discrete Mathematics	3	1	0	4
2	CSET-3002	Database Management Systems	3	0	0	3
3	CSET-3003	Digital System Design	3	0	0	3
4	CSET-3004	Object-Oriented Programming through Java	3	0	0	3
5	CSET-3005	Computer Network	3	0	0	3
	CSEL-3002	Data Base Management Systems Lab	0	0	2	1
6	CSEL-3003	Digital System Design Lab	0	0	2	1
7	CSEL-3004	Object-Oriented Programming through Java Lab	0	0	2	1
8	CSEL-3005	Social Responsibly and Community Engagement/NSS	0	0	2	1
9	CSEP-3006	Learning Project-I	0	0	2	1
		TOTAL				21

IV Semester [Second Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-4001	Programming Paradigm using Python	3	0	0	3
2	2CSET-4002	Computer Organization & Architecture	3	0	0	3
3	CSET-4003	Design and Analysis of Algorithms	3	0	0	3
4	CSET-4004	Operating System	3	0	0	3
5	CSET-4005	Professional Elective-I(From Bucket)	3	0	0	3
6	CSET-4006	Artificial Intelligence	3	0	0	3
7	CSEL-4001	Python Programming Lab	0	0	2	1
8	CSEL-4003	Design and Analysis of Algorithms Lab	0	0	2	1
9	CSEL-4004	Unix and Shell Programming Lab	0	0	2	1
10	CSEP-4007	Learning Project-II	0	0	2	1
		TOTAL				22

B.TECH IN COMPUTER SCIENCE & ENGINEERING

V Semester [Third Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-5001	Engineering Economics and Costing	2	0	0	2
2	CSET-5002	Automata Theory and Compiler Design	3	1	0	4
3	CSET-5003	Data Mining and Data Warehousing	3	0	0	3
4	CSET-5004	Professional Elective-II (From Bucket)	3	0	0	3
5	CSET-5005	Software Engineering	3	0	0	3
6	CSET-5006	Cyber Security	3	0	0	3
7	CSEL-5003	Data Mining Lab	0	0	2	1
8	CSEL-5005	Software Engineering Lab	0	0	2	1
9	CSEP-5007	Minor Project –I	0	0	4	2
10	CSEI-5008	Summer Internship-I	0	0	1	1
11	CSET-5009	Constitution of India	0	0	2	1
		TOTAL				24

VI Semester [Third Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-6001	Optimization Techniques	3	0	0	3
2	CSET-6002	Machine Learning	3	0	0	3
3	CSET-6003	Microprocessors and Microcontroller	3	0	0	3
4	CSET-6004	Professional Elective-III (From Bucket)	3	0	0	3
5	CSET-6005	Cloud Computing	3	0	0	3
6	CSET-6006	Open Elective-I (From Bucket)	3	0	0	3
7	CSEL-6002	Machine Learning Lab	0	0	2	1
8	CSEL-6005	Cloud Computing Lab	0	0	2	1
9	CSEP-6007	Minor Project Work-II	0	0	4	2
10	CSET-6008	Essence of Indian Knowledge Tradition	2	0	0	1
		TOTAL				23

B.TECH IN COMPUTER SCIENCE & ENGINEERING

VII Semester [Fourth Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-7001	Research Methodology	3	0	0	3
2	CSET-7002	Internet of Things	3	0	0	3
3	CSET-7003	Professional Elective-IV (From Bucket)	3	0	0	3
4	CSET-7004	Entrepreneurship Development	3	0	0	3
5	CSET-7005	Open Elective-II (From Bucket)	3	0	0	3
6	CSEL-7002	Internet of Things Lab	0	0	2	1
8	CSEP-7006	Major Project Work-I	0	0	6	3
9	CSEI-7007	Summer Industry Internship-II	0	0	2	1
		TOTAL				20

VIII Semester [Fourth Year]						
Sl. No.	Subject Code	Subject Name	L	T	P	Credit
1	CSET-8001	Professional Elective-V (From Bucket)	3	0	0	3
2	CSET-8002	Professional Elective-VI (From Bucket)	3	0	0	3
3	CSET-8003	Open Elective-III (From Bucket)	3	0	0	3
4	CSES-8004	Technical Seminar	0	0	0	1
5	CSEP-8005	Major Project Work-II	0	0	8	4
6	CSEP-8006	Comprehensive Viva-Voice	0	0	2	1
		TOTAL				15

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Professional Electives Bucket		
PE I - PE VI	AI &ML	Feature Engineering
		Soft Computing
		Data Visualization using Python
		Quantum Computing
		Data Analytics
		Natural Language Processing
		Pattern Recognition
		Computer Vision
		Leveraging AI in Healthcare
		Generative AI
		Augmented Reality & Virtual Reality
		Robotics and Automation
		PE I - PE VI
Data Preparation and Analysis		
Data Visualization		
Big Data Analytics		
Business Intelligence and Analytics		
Data Modelling		
Game Theory		
Edge Computing		
Data Security and Privacy		
Introduction to Block Chain Technology		
Data Analytics		
Data Visualization		
PE I - PE VI	IoT	
		IoT and Sensors
		Wireless Sensor Network
		Cryptography and Network Security
		Introduction to Block Chain Technology
		Edge and Fog Computing
		Robotics and Automation
		Human-Computer Interaction
		Drone Technology and IoT Integration
		Cloud Architecture
Ethical Hacking		

B.TECH IN COMPUTER SCIENCE & ENGINEERING

PE I - PE VI	CORE CSE	UI/UX Design
		Data Modelling
		Graph Theory
		Distributed Systems
		Cryptography and Network security
		Natural Language Processing
		Computer Graphics
		Parallel Computing
		Business Intelligence & Analytics
		Augmented Reality & Virtual Reality
		Data Analytics

Open Electives Bucket	
OE I	Web Development with PHP
	Sustainable Computing
	Bioinformatics
	Digital Signal Processing
	Responsible AI
OE II	Android Application Development
	IOT Security and Privacy
	IOS Development
	Medical Image processing
	IOT Application Development
OE III	Data Analytics
	.NET programming
	Embedded System
	Genome Data Science
	Deep Learning

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Detailed Syllabus

First Semester

Theory

Programming for Problem Solving using C

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Programming for Problem Solving using C
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	ES
Course Objective	The subject aims to provide the student with: CO1. An understanding of basic concepts of computer programming. CO2. An introduction to the fundamentals of C language. CO3. An understanding of problem-solving programs.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Memorize features of structure oriented programming and describe control statements, arrays, structures and pointers. CO2. Classify various types of statements and demonstrate programs on control structures, arrays, functions, pointers and structures. CO3. Solve problems using different programming logics and can able to discover better solutions. CO4. Analyse different programs by experimenting on them and estimating their efficiency. CO5. Evaluate complex programs by verifying their logics and justify their results.

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Algorithm /Flowcharts / Pseudocode, Generation of Programming Languages. Introduction to Language:	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Structure of C Program, Compiling and Executing C Code, Keywords, Identifiers, Primitive Data types in C, variables, constants, input/output statements in C. Operators and Expressions, Operator precedence and Associativity	
UNIT2	Control Structure and Array Conditional Branching/Selection Logic: if, if..else, else if ladder, nested if, switch..case. if, if else and else if ladder and switch, Iteration Logic: Loops - Iterative statements, nested loops, break and continue statements. Arrays & Strings: One-dimensional, Multi-dimensional arrays, operations on array, String Functions and operations.	CO2
UNIT3	Function Function: Declaration, Definition, Call and return, call by value, Call by reference, Scope of variables, Storage classes, Recursive functions, Recursion vs Iteration. Functions with array and string.	CO3
UNIT4	User Defined Data Types: Structures Declaration and initialization of structures, accessing structure elements, nested structures, structures and arrays, structures and functions, Structure vs Union, Pre-processor, typedef and Storage classes	CO4
UNIT5	Pointers: Idea of pointers, Defining pointers, Use of Pointers in matrices. Reading, writing and manipulating Strings, understanding computer memory, accessing via pointers, pointers to arrays, dynamic allocation, drawback of pointers. Dynamic memory allocation: Memory Layout, Implicit vs. Explicit Allocation; Static vs. Dynamic Allocation; Basics of File Handling	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Forouzan, B. A., & Gilberg, R. F. (2007). A Structured Programming Approach Using C (3rd ed.). Cengage Publication.
2. Kernighan, B. W., & Ritchie, D. M. (2015). The C Programming Language (2nd ed.). Prentice Hall of India

Reference Books:

1. Gottfried, B. (2017). Schaum's Outline of Programming with C (3rd ed.). McGraw-HillBook.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO3	3	3	3	2	1	-	-	-	-	-	-	-
CO4	3	3	3	3	2	1	-	-	-	-	-	-
CO5	3	3	3	3	2	1	1	-	-	-	-	-

Engineering Mathematics -I

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Engineering Mathematics -I
Course Code	
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	ES
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none">1. Infinite sequence of series2. Theory of matrices including elementary transformations, rank and its application in consistency of system of linear equations, eigenvalues, eigenvectors etc.3. Multivariable functions, their limits, continuity, partial differentiation, properties and applications of partial derivatives.4. Integrals of multivariable functions viz. Double and triple integrals with their applications5. Properties like gradient, divergence, curl associated with derivatives of vector point functions and integrals of vector point functions
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. decide the behaviour of sequences and series using appropriate tests.</p> <p>CO2. get an understanding of partial derivatives and their applications in finding maxima - minima problems.</p> <p>CO3. apply the principles of integral to solve a variety of practical problems in engineering and sciences</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<p>CO4. demonstrate a depth of understanding in advanced mathematical topics</p> <p>CO5. Enhance and develop the ability of using the language of mathematics in engineering.</p>
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT 1	Sequences and Series: Infinite Sequences, Monotonic Sequences, Bounded Sequences, Convergence of Sequences, Cauchy's General Principle of Convergence. Infinite series, Convergence of Infinite Series, Tests for Convergence: Comparison tests, Ratio test, Cauchy's root test, Raabe's test, Logarithmic Test, Gauss test, Cauchy's Integral test, Alternating series, Leibnitz test.	CO1
UNIT 2	Matrices, Special Matrices (Symmetric, Skew - Symmetric, Orthogonal Matrix, Unitary Matrix), Elementary Transformations, Rank of a Matrix, Row - reduced Echelon form, Normal Form, Vectors, Linear Independence and Dependence of Vectors, System of linear equations, Introduction to Linear Transformations, Eigenvalues, Eigenvectors, Cayley - Hamilton theorem.	CO2
UNIT 3	Multivariable Differential Calculus Function of several variables, Limit, Continuity, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Chain rules, Jacobians and its properties, Taylor series for function of two variables, Maxima – Minima, Lagrange's method of multipliers.	CO3
UNIT 4	Multivariable Integral Calculus Double integrals, double integrals in polar coordinates, Change of order of integration, Triple Integrals, cylindrical and spherical coordinate systems, transformation of coordinates, Applications of double and triple integrals in areas and volumes. Beta and gamma functions.	CO4
UNIT 5	Vector Calculus Scalar and vector point functions, gradient, directional derivative, divergence, curl, vector equations and identities. Line Integral, Work done, Conservative field, Green's theorem in a plane, Surface and volume integrals, Gauss – divergence theorem, Stoke's theorem.	CO5

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. H. Anton, I. Brivens and S. Davis, Calculus, 10th Edition, John Wiley and sons, Singapore Pte. Ltd., 2013.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010. 19

Reference Books:

1. M. J. Strauss, G. L. Bradley And K. J. Smith, Calculus, 3rd Ed, Dorling Kindersley (India) Pvt. Ltd. (P Ed), Delhi, 2007.
2. M. D. Weir, J. Hass and F. R. Giordano: Thomas' Calculus, 11th edition, Pearson Educations, 2008.
3. S.C. Malik and S. Arora, Mathematical Analysis, New Age International, 1992.
4. David C. Lay, Linear Algebra and its Applications (3rd Edition), Pearson Ed. Asia, Indian Reprint, 2007. 5. D. G. Zill and W.S. Wright, Advanced Engineering Mathematics, Fourth Edition, 2011.

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

Basic Electrical Engineering

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Basic Electrical Engineering
Course Code	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	ES
Course Objective	<p>This course envisions to impart to students to:</p> <ol style="list-style-type: none"> 1. Classify different electrical circuit elements and apply suitable laws and theorems for the analysis of electrical systems. 2. Represent series / parallel electric / magnetic circuits; 3. Employ three phase circuits for transfer of electrical power both under balanced and unbalanced condition. 4. Interpret the system responses under different operating conditions such as resonance, mutual coupling and star-delta conversion. 5. Assess the working of different A.C. electrical machines
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Solve electrical circuits using Kirchhoff's laws and apply concepts of magnetic circuits in electrical systems.</p> <p>CO2. Analyse A.C. electrical circuits having dependent and independent sources for computation of responses such as voltage, current, power.</p> <p>CO3. Evaluate the advantages of 3 phase system in electrical industrial applications and differentiate between balanced and unbalanced operation.</p> <p>CO4. Assess the applicability of circuit theorems for practical applications.</p> <p>CO5. Integrate the sources of energy for transferring power to the consumers.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	Introduction: Importance of Electrical Engineering in day-to-day life, Electrical elements, properties and their classification, Ideal and Real Sources, Source Conversion D.C. Circuits: KCL and KVL, Loop current and Nodal voltage method Steady state analysis with independent and dependent sources; Star-Delta conversion. Magnetic Circuits: Introduction, Series-parallel magnetic circuits, Analysis of Linear and Nonlinear magnetic circuits, Energy storage, A.C. excitation, Eddy currents and Hysteresis losses.	CO1
UNIT 2	Single-phase AC Circuits: Series Circuits: Common signals and their waveforms, RMS and Average value, Form factor & Peak factor of sinusoidal waveform, Impedance of Series circuits. Phasor diagram, Active Power, Power factor. Power triangle. Parallel Circuits: Admittance method, Phasor diagram. Power, Power factor.	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Power triangle, Series- parallel Circuit, Power factor improvement, Series and Parallel Resonance: Resonance curve, Q-factor, Dynamic Impedance and Bandwidth.	
UNIT 3	Three-Phase Circuits: Line and Phase relation for Star and Delta connection, Power relations, Analysis of balanced and unbalanced 3 phase circuits, Measurement of Power.	CO3
UNIT 4	Circuit Theorems: Superposition theorem, Thevenin's & Norton's Theorem, Maximum Power Transfer theorem for Independent and Dependent Sources for DC and AC circuits. Coupled Circuits (Dot rule), Self and mutual inductances, Coefficient of coupling.	CO4
UNIT 5	Working principles of AC Generators, motors and transformers, working principles of measuring equipments such as digital voltmeter, ammeter, power factor meter and wattmeter.	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text books:

1. Hughes Electrical Technology, Pearson, 10th edition, 2011.
2. Fitzgerald and Higginbotham, Basic Electrical Engineering, McGraw Hill Inc, 1981.
3. D.P. Kothari and I.J. Nagrath, Basic Electrical Engineering, 3rd Edition, TMH, 2009.

Reference books:

1. W. H. Hayt, Jr J. E. Kemmerly and S. M. Durbin, Engineering Circuit Analysis, 7th Edn TMH, 2010.
2. Electrical Engineering Fundamental, Vincent Del Toro, Prentice Hall, New Delhi.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	-	-	-	-	-	-	-	-
CO2	3	3	1	2	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1
CO5	3	1	1	1	-	1	2	-	-	-	-	1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Universal Human Values

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Universal Human Values
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	HS
Course Objective	<p>This course envisions to impart to students to:</p> <ol style="list-style-type: none">1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.2. To help students initiate a process of dialog within themselves to know what they ‘really want to be’ in their life and profession.3. To help students understand the meaning of happiness and prosperity for a human being.4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.5. To facilitate the students in applying the understanding of harmony in existence in them profession and lead an ethical life.
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Understand the significance of value inputs in a classroom, distinguish between values and skills,</p> <p>CO2. Understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society</p> <p>CO3. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.</p> <p>CO4. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious Society</p> <p>CO5. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.</p> <p>CO6. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description	CO Mapping
UNIT 1	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self- Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	CO1
UNIT 2	Understanding Harmony in the Human Being – Harmony in Myself Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha, Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	CO2
UNIT 3	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT 4	Understanding Harmony in the Nature and Existence – Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	CO4
UNIT 5	Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	-	-	-	1
CO2	-	-	-	-	-	3	-	3	1	1	-	2
CO3	-	-	-	-	-	2	-	3	-	-	-	1
CO4	-	-	-	-	-	3	-	3	3	2	-	1
CO5	-	-	-	-	-	2	3	1	-	1	-	1
CO6	-	-	-	-	-	3	1	3	1	1	-	2

French Language

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	French Language
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	HS
Course Objective	<ol style="list-style-type: none"> 1. Introduce students to the basics of the French language (A1 level). 2. Develop oral and written comprehension skills for simple interactions. 3. Introduce fundamental grammar and essential vocabulary. 4. Familiarize students with cultural aspects of the Francophone world
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1: Sound and pronunciation of French words; Use simple expressions for greetings, self-introduction, and asking basic questions.</p> <p>CO2: Employ vocabulary related to family, professions, city, housing, and leisure.</p> <p>CO3: Read and understand short texts (announcements, dialogues).</p> <p>CO4: Write simple sentences (personal introduction, email, postcard).</p> <p>CO5: Identify elements of Francophone culture and compare them with their own.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>We discover French:</p> <ul style="list-style-type: none"> • Objectives: Discover the French language; Spell words using the French alphabet; Learn basic numbers • Grammar: Subject pronouns (<i>je, tu, il/elle</i>); Verbs: <i>être, s'appeler</i>; Definite articles; Gender of country names • Vocabulary: Introduction and first names; Numbers; Country names; Days; Months and Seasons <p>Activities: Short dialogues, role-play for greetings, spelling practice games, interactive oral drill</p>	CO1
UNIT 2	<p>We learn French for</p> <ul style="list-style-type: none"> • Objectives: Greetings; Introduce yourself and say goodbye; Ask for and give information; Give personal information; Introduce and identify a person; Ask question about identity and speak about your French class; Inform about a leaning object. • Grammar: <i>Tu</i> or <i>Vous</i>; Indefinite articles; Interrogative words; Personal Subject pronouns ; Verbs <i>Parler</i> and <i>s'appeler</i> in present tense ; <i>C'est</i> or <i>Il est/Elle est</i> ; Interrogative adjectives <i>quel(s), quelle(s)</i> ; Verb <i>avoir</i> in present tense and Possessive adjectives ; <i>Parce que</i> and <i>pour</i> • Vocabulary: Politeness; Nationalities; Professions; Introductions; Identities <p>Activities: Create an identity card, write a self-introduction, listen to short interviews, classroom survey on hobbies</p>	CO2
UNIT 3	<p>Get to know each other:</p> <ul style="list-style-type: none"> • Objectives: Name the countries and cities; Name and locate places in a city; Locate a place and indicate a mode of transportation; Make acquaintances; Talk about a type of accommodation; Exchange information about an accommodation. • Grammar: Prepositions (Countries and cities name); Definite and Indefinite articles; Preposition of place and Contracted articles; Verbs <i>Aller, Habiter, Venir</i> and <i>Prendre</i> in present tense; Demonstrative adjectives. 	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<ul style="list-style-type: none"> • Vocabulary: Names of countries and cities, Places in a city, Cardinal points and modes of transportation; Accommodation. • Activities: Role-play ordering at a café, reading a map, writing a postcard from a trip. 	
UNIT 4	<p>We speak the same language</p> <ul style="list-style-type: none"> • Objectives: Speak about your family; Describe and characterize a person/people; Express preferences; Talk about yourself, your profession, your passion and your dream; Describe your activities; Explain a health problem. • Grammar: Singular and plural possessive adjectives; The masculine, the feminine and the plural of descriptive adjective; Present tense of <i>er</i> ending verbs. • Vocabulary: Family, Professions, Sports and artistic activities; Body parts. <p>Activities: Describe a photo of a living room, write a short email about your home, role-play finding an apartment.</p>	CO4
UNIT 5	<p>We speak about our daily routine:</p> <ul style="list-style-type: none"> • Objectives: Tell the time and schedule; Speak about your hobbies and daily routine; Talk about your workday; Speak about your outings; Propose an outing, invite, accept or refuse an invitation. • Grammar: Different ways to tell time; Pronominal verbs; Verbs <i>Pouvoir, Devoir, Vouloir, Sortir, Partir, lire</i> and <i>écrire</i> in present tense; Pronoun <i>on</i>; Ask questions; Imperative • Vocabulary: Time and schedule; Daily routine and Habits; Outings <p>Activities: Plan a weekend activity, write a short message to invite someone, practice dialogues for accepting/refusing invitations</p>	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Textbooks:

1. **Nathalie, Hirschsprung, and Tony, Tricot, *Cosmopolite 1: Méthode de français (A1)*.** Hachette, 2018.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

References:

1. Nathalie, Hirschsprung, and Tony, Tricot, *Cosmopolite 1: Cahier d'activités (A1)*. Hachette, 2018.
2. Dondo, Mathurin Marius, *Modern French Course*, Oxford University Press, 1997.

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	3	-	-	-	1
CO2	-	-	-	-	-	3	-	3	1	1	-	2
CO3	-	-	-	-	-	2	-	3	-	-	-	1
CO4	-	-	-	-	-	3	-	3	3	2	-	1
CO5	-	-	-	-	-	2	3	1	-	1	-	1
CO6	-	-	-	-	-	3	1	3	1	1	-	2

PRACTICAL/SESSIONAL

Problem Solving using C Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Problem Solving using C Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	ES
Course Objective	<ol style="list-style-type: none"> 1. To develop programs for problems on different applications of array, functions, pointers and structure. 2. To analyse different problems by comparing and implementing in programming.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Memorize features of structure oriented programming and describe control statements, arrays, structures and pointers.</p> <p>CO2. Classify various types of statements and demonstrate programs on control structures, arrays, functions, pointers and structures.</p> <p>CO3. Solve problems using different programming logics and can able to discover better solutions.</p> <p>CO4. Analyse different programs by experimenting on them and estimating their efficiency.</p> <p>CO5. Evaluate complex programs by verifying their logics and justify their results.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Lab Experiment 1: Familiarization with programming environment

- 1) Introduction to OS: Before starting experiments explain the facilities and operations of OS.
- 2) Introduction to the C compiler, Compilation and Execution Process & writing simple programs.

Lab Experiment 2: Simple computational problems using arithmetic expressions.

- 1) Write a program to input radius of a circle and Find the area, perimeter of it.
- 2) Write a program to input two numbers and swap them using an intermediate variable.
- 3) Write a program to input two float values and find their sum
- 4) Write a program to input 2 sides i.e: length and breadth of a rectangle. Find the area and perimeter of it.

Lab Experiment 3: Simple computational problems using arithmetic expressions.

- 1) Write a program to accept Fahrenheit and calculate its equivalent Celsius.
- 2) Write a program to input three unequal numbers and find the greatest using conditional operator.
- 3) write a program to find simple interest when principle amount, no. of terms and rate of interest given.
[Given formula: $si=(p*t*r)/100$]
- 4) write a program to find the area of a triangle when the 3 sides of it given as input.
[Given formula: $s=(a+b+c)/2$ and $area= \sqrt{s*(s-a)*(s-b)*(s-c)}$]

Lab Experiment 4: Simple computational problems using arithmetic expressions.

- 1) Write a program to input three unequal integers and find the largest number using conditional operator.
- 2) Apply Pythagorean theorem for finding the distance between two points i.e. side 'a' when the two sides namely 'b', 'c' are given as input. [Given formula is $a=\sqrt{b^2+c^2}$]
- 3) John, Ram and shah were fishing in a river bank. Input the no. of fishes caught by each person and display who have caught more fishes (use conditional operator).
- 4) A boy is running in a circular playground having radius R given input. What will be the distance and displacement from one end to other end of ground? [Formula distance= $\pi*R$ and Displacement= $2*R$]

Lab Experiment 5: Problems involving using if statement

- 1) In your garden two flower plants of rose and lily are growing. Input the growth of each plant in centimetres. Display the plant whose height is more. (use if..else)
- 2) In a software company a project team of 3 members namely manvi, shyam and William. Input their job experience in no. of years. The team lead must have more experience. Display who can be team lead. (use if..else)
- 3) Write a program to input 3 co-efficient values and find the real roots of quadratic equation.
- 4) Write a program input a digit within 0 to 06. Display week day example: 0 for Sunday, 1 for Monday etc (use else if ladder).

Lab Experiment 6: Problems involving using switch..case

- 1) Write a program to input a lower case alphabet and test whether it is vowel or consonant.(using else..if and switch both)
- 2) Write a program to input an arithmetic operator and two operands. Calculate and display the result as per the given operator using switch..case.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

3) Write a program to find the greatest among three numbers.(using else..if and switch both)

Lab Experiment 7: Programming with while loop and do..while loop:

- 1) Write a program to input a number and test whether it is prime number or not using while statement.
- 2) Write a program to test a number is perfect or not using while statement.
(ex: The perfect number is 6, which is the sum of 1, 2, and 3. Other perfect numbers are 28, 496, and 8,128.)
- 3) Write a program to input a positive number and test whether it is palindrome or not using do..while statement.
- 4) Write a program to accept a positive integer and test it for Armstrong or not using do..while statement.

Lab Experiment 8: Programming with For loops and nested Loop:

- 1) The length of two rods are given as input in meters. The rods are to be cut into pieces of equal length. Find the maximum length of each piece. (use for loop)
- 2) Write a program to generate a series of Fibonacci numbers using for statement
- 3) Write a program to calculate the following sum using nested for statement:
Sum = $1 - (x^2)/2! + (x^4)/4! - (x^6)/6! + (x^8)/8! - (x^{10})/10! \dots (x^n/n!)$
- 4) Write a program to generate the following pyramid using nested for statement:

```
      1
     1 2 1
    1 2 3 2 1
   1 2 3 4 3 2 1
```

Lab Experiment 9: Programming with 1D Array and 2D Array

- 1) Write a program to accept 10 integers in to an array and find largest and smallest integers present in them.
- 2) Write a program to input 10 numbers into an array. Find how many prime numbers exist in the array.
- 3) Write a program to input values into a square matrix of size 3X3. Display the transpose of the matrix.
- 4) Write a program to input elements into two matrices A[3][4], B[4][3]. Multiply A and B store result into matrix C[3][3]. Display the resultant matrix C.

Lab Experiment 10: Programming with Strings Handling Operations

- 1) Write a program to input a string and find the frequency of a given character in it.
- 2) Write a program to input two strings and compare them for equality without using library function.
- 3) Write a program to input a string and test it for palindrome or not using library functions.

Lab Experiment 11: Programming with User Defined Functions

- 1) Write a C program which contains three UDF's namely add(), subtract() and multiply(). Each function accepts two integers as their arguments and calculate and return the results.
- 2) Write a program to create an UDF and test a number is prime or not.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

3) Write a program to create an UDF which accepts an array of 10 integers and find the largest element and smallest element present in the array.

Lab Experiment 12: Programming with Recursive Functions

- 1) Write a program to find the factorial of a number using recursive function.
- 2) Write a program to accept 10 elements into an integer array. Find the largest element present using recursive function.
- 3) Write a program to generate Fibonacci series using a recursive function.

Lab Experiment 13: Programming with Pointers

- 1) Write a program to swap two numbers using User Defined Function by applying call by address concept.
- 2) Write a program to perform matrix addition. Create an UDF which accepts the two matrices using two pointers and performs matrix addition.
- 3) Write a program to store N integer values using dynamic memory allocation. Then find the largest, smallest present in it using User Defined Function.
- 4) Write a program to store N integers using dynamic memory allocation. Find the average value of the integers using a user defined function.

Lab Experiment 14: Programming with Structures

- 1) Write a program create a structure PRODUCT having members Product no, Name and Price. Using a pointer Input 5 product details into a structure array and then display those products whose price is >1000 rupees.
- 2) Write a program to store 11 cricket players' details into an array of structure. The structure having member's player name, team name and batting average. Displays the name of players whose batting average is >=30.
- 3) Write a program to create a structure EMPLOYEE to store N employee details using DMA having members: employee no, name, salary. Create a function which displays only those employee names whose salary >=50000.
- 4) Write a program to create a structure for store library books using a structure having members book no, name, author, price. Store N books details using dynamic memory allocation. Create an UDF which accepts these books details using pointer and then display only those books whose cost >=1000.

Topic Beyond Syllabus

- 1) Write a program to input a set of numbers into a file called NUM.TXT. Display only the even numbers present in the file and also display their sum.
- 2) Write a program to store a paragraph into a file A.TXT using command line arguments and then create a copy of it with name B.TXT. =

Teaching Methods: Chalk& Board/ PPT/Video Lecture

- A case study can be given to each student for each UNIT.
- A Mini Project can be given which the student has to complete during the semester break.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

1. E. Balaguruswamy, Programming in ANSI C, 7th edition, Tata McGraw-Hill
2. Let us 'C' by Yashwant Kanethekar, 16th edition, BPB Publications

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd edition, Prentice Hall of India
2. Programming in C, by Reema Thareja, 2nd edition, OUP India
3. C Programming and Coding by swati saxena, BPB Publications

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	-	-	-	-
CO2	3	2	2	1	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	1	-	-	1
CO4	3	3	3	3	3	1	-	-	1	1	-	1
CO5	3	3	3	3	3	1	-	-	1	1	-	1
CO6	3	3	3	3	3	1	-	-	2	1	-	1

Basic Electrical Engineering Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	I
Course Title	Basic Electrical Engineering Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	ES

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	<ol style="list-style-type: none"> 1. To demonstrate the various theorem and power transform 2. To explain PN junction characteristics and its applications. 3. To understand the frequency response of BJT amplifier and OPAMP. 4. To Realize logic gates and implement simple Boolean expression. 5. To explain the Amplitude Modulation and Frequency Modulation
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1: Explain the concept of circuit laws and network theorems and apply them to laboratory measurements.</p> <p>CO2: Be able to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and DC Machines</p> <p>CO3: Acknowledge the principles of operation and the main features of electric machines and their applications.</p> <p>CO4: Acquire skills in using electrical measuring devices.</p> <p>CO5: Understand the wiring methods, electricity billing, and working principles of circuit protective devices and personal safety measures</p>

Course Outline

Unit	Description
Lab 1	Explanation and Verification of Thevenin's Theorem.
Lab 2	Experiment to Verify Superposition Theorem.
Lab 3	Verification of Maximum Power Transfer Theorem.
Lab 4	To study V-I characteristics of diode.
Lab 5	To study the input & output characteristics of BJT in CE configuration.
Lab 6	To study the full wave rectifier circuit with &without filter and determine the ripple factor.
Lab 7	To study the phenomenon of resonance in series RLC circuit.
Lab 8	Determination of losses in single phase transformer by OCT and SCT.
Lab 9	To calibrate a single phase induction type energy meter.
Lab 10	To study the running and reversing of a three phase SCIM.
Lab 11	Study of OP Amp based inverting and non-inverting amplifier.

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Text Books:

1. Millman J., Halkias C.C., Parikh Chetan, “Integrated Electronics: Analog and Digital Circuits and Systems”, Tata McGraw-Hill, 2/e.
2. Mano M.M., “Digital Logic and Computer Design”, Pearson Education, Inc, Thirteenth Impression, 2011.
3. Singal T. L., “Analog and Digital Communications”, Tata McGraw-Hill, 2/e.
4. Haykin S., Moher M., “Introduction to Analog & Digital Communications”, Wiley India Pvt. Ltd., 2/e.

Reference Book:

1. Boylstead R.L., Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson Education, Inc, 10/e.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	-	-	-	1	-	-	1
CO2	3	2	1	3	3	-	-	1	1	2	-	1
CO3	3	3	1	3	2	-	-	-	1	-	-	1
CO4	3	3	2	3	2	-	-	-	1	-	-	1
CO5	1	1	1	1	1	-	-	-	2	3	-	1

II Semester

Data Structures

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Data Structures
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	PC
Course Objective	This course enables the students to understand 1. Develop algorithms for performing different operations on arrays, stack, Queue, linked list. Analyze the difference between them and understand different applications. Understand different searching and sorting methods and applications.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	2. Understand and analyze Binary search Tree, AVL Tree, Heap Tree and their applications. Understand the memory representation of graph, its traversal methods and applications. Analyze the Hashing techniques in compare with other sorting techniques.
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Understand the basic concepts of data structures, remember the fundamental concepts.</p> <p>CO2. Understand the methods by comparing the different data structures concepts.</p> <p>CO3. Develop algorithms for implementing different operations on data structures.</p> <p>CO4. Analyses of the algorithms regarding different operations on data structures.</p> <p>CO5. Solve and evaluate complex problems by coding on linear and non-linear data structures.</p> <p>CO6. Design algorithms on advanced concepts of data structure by implementation in different application of data structure.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Basic concepts: Abstract Data Type, Data structures and types. Algorithm specification, 1D array: operations, 2D array: row major order and column major order, sparse matrix</p> <p>Searching: Linear search and Binary search on elements in a linear array.</p> <p>Sorting: Bubble sort, Insertion sort, Selection sort, quick sort, radix sort using linear array.</p>	CO1
UNIT 2	<p>Stack: Basic concepts, operations and implementation of stack using arrays, Mathematical procedure for conversions of arithmetic expressions. Applications of stack: infix to postfix conversion and postfix evaluation.</p> <p>Queue: Linear queue, operations and implementation using arrays, circular queue and its operations, Basics concepts of Double ended Queue and priority queue</p>	CO2
UNIT 3	<p>Linked Lists: The concepts and operations: insertion of a node (at the beginning, at the end, at location), deletion of a node (from the beginning, from the end, from a specific location), searching for a node in single linked list, circular single linked list and</p>	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Double linked list. Implementation of stack and queue using single linked list. Basic concept of Circular double linked list.	
UNIT 4	Trees: Introduction and Terminology, Binary Trees: Memory Representation of Binary Trees, Traversal, Construction, Expression Tree and its construction of using stack. Binary Search Trees: Algorithm for construction, searching, insertion and deletion operation, Height Balanced trees: Balance factor and its construction Heaps: Introduction to binary heaps, Max-heap, Min-heap, Creating Heap and using it for heap Sort.	CO4
UNIT 5	Graphs: Terminologies, Graph Memory representation - Adjacency matrix, Incidence Matrix, Linked Representation, path matrix, Warshall's Algorithm to find path matrix, Graph Traversals (BFS & DFS), Topological Sorting. Hashing: Hashing Functions: Division, Mid-square, Folding methods. Collision, linear probing, chaining	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. "Fundamental of Data Structure" (Schaums Series) Tata-McGraw-Hill.
2. Pai: "Data Structures & Algorithms; Concepts, Techniques & Algorithms "Tata McGraw Hill.
3. Gilberg and Forouzan: "Data Structure- A Pseudo code approach with C" by Thomson publication

Reference Books:

1. "Fundamentals of data structure in C" Horowitz, Sahani & Freed, Computer Science Press.
2. "Data Structures and algorithms" by Narasimha Karumanchi, CareerMonk Publications
3. "Data structures through C in depth" by S.K.Srivastava, BPB Publications

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	2
CO3	3	3	3	2	1	-	-	-	1	-	1	2
CO4	3	3	2	3	2	-	-	-	-	1	-	2
CO5	3	3	3	3	2	-	-	1	1	1	1	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Engineering Mathematics -II

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Engineering Mathematics -II
Course Code	
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	BS
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none"> 1. Various methods to solve linear differential equations of second and higher order 2. Various methods to solve linear differential equations of second and higher order special functions viz. Legendre's and Bessel's and different properties associated with them 3. Diverse mathematical techniques for solving partial differential equations of first order and higher order, along with their applications in wave and heat equations using Fourier series 4. The theory of functions of a complex variable, complex differentiation and integration 5. Infinite series (Taylor and Laurent series) for complex variable function, the theory of residues with applications to evaluation of integrals
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO7. Investigate the occurrence of differential equations in science and engineering and the methods available for their solutions.</p> <p>CO8. Formulate any real life problem in terms of differential equations.</p> <p>CO9. Gain an understanding on complex variable function, analytic functions and their properties using different theorems.</p> <p>CO10. Demonstrate a depth of understanding in advanced mathematical topics</p> <p>CO11. Enhance and develop the ability of using the language of mathematics in engineering</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	Ordinary Differential Equations – I: Linear differential equations, Wronskian, Linear independence and dependence of solutions, Linear differential equations of second and higher order, Operator	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	method, Euler – Cauchy’s differential equation, Legendre’s linear differential equation, Method of variation of parameters, Method of change of independent variable, Normal form method.	
UNIT 2	Ordinary Differential Equations – II operation Power series, ordinary and singular points of differential equation, Power and Frobenius series solutions. Bessel’s differential equation and its series solution, Bessel function of first kind and its properties. Legendre’s differential equation and its series solution, Legendre’s polynomial and its press	CO2
UNIT 3	Partial Differential Equations Fourier series, Euler formulae for Fourier series for length of interval, Dirichlet conditions, Fourier series for arbitrary length of interval, Half range Fourier series. Linear and quasi – linear partial differential equations, Lagrange’s method, Linear – partial differential equations with constant coefficients, Method of separation of variables and its application in solving one dimensional wave and heat equations.	CO3
UNIT 4	Complex Variable Function of a complex variable, Limit, Continuity, Differentiability, Analyticity, Analytic functions, Cauchy – Riemann equations (Cartesian and Polar form), Harmonic functions, Complex Integration, Cauchy’s theorem, Cauchy’s Integral formula, Taylor and Laurent series for complex variable functions, Residues, Residue theorem and its applications in evaluation of real integrals.	CO4
UNIT 5	Probability and Statistics Definition and scope of statistics, average and dispersion, skewness and kurtosis, graphical statistics, classical and empirical definitions of probability, addition theorem, Conditional probability, multiplication theorem, independent events, Bayes’ theorem, discrete and continuous random variables, cumulative distribution function, probability mass and density functions, mathematical expectation, variance, moment generating function.	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

3. D. G. Zill and W.S. Wright, Advanced Engineering Mathematics, Fourth Edition, 2011.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004. 22
5. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing, Third Edition, 2009
6. R. A . Johnson, I. Miller and J. Freund: Probability and Statistics for Engineers, PHI
7. S. C. Gupta and V.K . Kapoor.: Fundamental of Mathematical Statistics, Sultan Chand and Sons

Reference Books:

1. M. J. Strauss, G. L. Bradley And K. J. Smith, Calculus, 3rd Ed, Dorling Kindersley (India) 1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition ., Wiley India, 2009.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
4. G. F. Simmons, Differential Equations with Applications and Historical Notes, TMH, 2nd ed., 2003.
5. J. E. Freund: Mathematical Statistics, Pearson 6. P. L. Meyer: Introductory Probability and Statistical Applications, Oxford & IBH.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	2
CO2	3	3	2	1	-	-	-	-	-	-	-	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2
CO4	3	2	1	1	-	-	-	-	-	-	-	3
CO5	3	3	2	1	-	-	-	-	-	1	-	3

Basic Electronics

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Basic Electronics
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Type	ES
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none"> 1. To understand PN Junction, diodes and their applications. 2. To comprehend BJT, FET and their bias configurations. 3. To grasp importance of feedback in amplifier circuits, op amp and its applications. 4. To understand number system, Logic Gates and Boolean algebra. 5. To apprehend fundamentals of communication technology.
Course Outcome (COs)	<p>CO1. Explain PN Junction, diodes and their applications. CO2. Appraise the BJT, FET and their biasing techniques. CO3. Comprehend feedback in amplifier circuits, op amp and its applications. CO4. Translate one number system into another, build circuits with Logic Gates, electronic components and OPAMP IC 741 and analyze the measurement results using CRO. CO5. Appraise the fundamentals of communication technology.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	Diodes and Applications: Introduction to PN junction diodes; Characteristics of semiconductor diodes: V-I characteristics, diode-resistance, temperature-dependence, diode-capacitance; DC & AC load lines; Breakdown Mechanisms; Zener Diode – Operation and Applications; Diode as a Rectifier: Half Wave and Full Wave Rectifiers with and without C-Filters.	CO1
UNIT 2	Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Input and Output Characteristics of CB, CE and CC Configurations, dc and ac load line analysis, operating point, Transistor biasing: Fixed bias, emitter bias/self-bias, Low-frequency response of CE amplifier. Field Effect Transistors: JFET, Idea of Channel Formation, Pinch-Off and saturation Voltage, Current-Voltage Output Characteristics; MOSFET: Basic structure, operation and characteristics.	CO2
UNIT 3	Sinusoidal Oscillators: Concept of positive and negative feedback, Barkhausen criterion for sustained oscillations, Determination of Frequency and Condition of oscillation, Hartley and Colpitt's oscillator Operational Amplifiers: Characteristics of an Ideal and	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Practical Operational Amplifier (IC 741), Inverting and non-inverting amplifiers, Offset error voltages and currents; Power supply rejection ratio, Slew Rate and concept of Virtual Ground, Summing and Difference Amplifiers, Differentiator and Integrator, RC phase shift oscillator.	
UNIT 4	Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Symbolic representation, Boolean algebraic function and Truth table of different Digital logic Gates (AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR); Realization of Basic logic gates using universal gates, Adder, Subtractor, adder/subtractor.	CO4
UNIT 5	Electronic communication: Introduction to electronic communication system, Electromagnetic Communication spectrum band and applications, Elements of Electronic Communication System; Merits and demerits of analog and digital communication, Modes of communication; Signal radiation and propagation; Need for modulation; Introduction to Amplitude modulation and Angle modulation.	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Millman J., Halkias C.C., Parikh Chetan, “Integrated Electronics: Analog and Digital Circuits and Systems”, Tata McGraw-Hill, 2/e.
2. Mano M.M., “Digital Logic and Computer Design”, Pearson Education, Inc, Thirteenth Impression, 2011.
3. Singal T. L., “Analog and Digital Communications”, Tata McGraw-Hill, 2/e.
4. Haykin S., Moher M., “Introduction to Analog & Digital Communications”, Wiley India Pvt. Ltd., 2/e.

Reference Book:

1. Boylestad R.L., Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson Education, Inc, 10/e.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO3	3	3	2	2	1	-	-	-	-	-	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	2
CO5	3	2	1	1	-	-	-	-	-	-	-	1

Engineering Physics

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Engineering Physics
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	BS
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none"> 1. To explain principles of physical optics. 2. To construct Maxwell's equations from basic principles and use it to solve electromagnetic plane wave equations. 3. To distinguish between Newtonian Mechanics and special theory of relativity and develop the relationship of length contraction, time dilation and Einstein energy mass relation and to apply the concepts of special theory of relativity in various field of physics and engineering. 4. To illustrate the phenomena of old quantum theory and derive Heisenberg uncertainty principle and Schrödinger's equations. 5. To understand basic lasing action, study various types of lasers and to have basic idea of fiber optics.
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. To interpret the intensity variation of light due to Polarization, interference and diffraction.</p> <p>CO2. To formulate and solve the engineering problems on electromagnetism</p> <p>CO3. To explain special theory of relativity and apply its concepts in various fields of physics and engineering.</p> <p>CO4. To explain fundamentals of quantum mechanics and apply it to problems on bound states</p> <p>CO5. To analyze working principle of lasers and to summarize its applications.</p>

Course Outline

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Unit	Description	CO Mapping
UNIT 1	Physical Optics: Polarization, Malus' Law, Brewster's Law, Double Refraction, Interference in thin films (Parallel films), Interference in wedge-shaped layers, Newton's rings, Fraunhofer diffraction by single slit, Double slit.	CO1
UNIT 2	Electromagnetic Theory: Curl, Gradient, Divergence, Gauss theorem, Stokes theorem, Gauss's law, Applications, Concept of electric potential, Relationship between E and V, Polarization of dielectrics, dielectric constant, Boundary conditions for E & D, Gauss's law in magnetostatics, Ampere's circuital law, Boundary conditions for B & H, Equation of continuity of charge, Displacement current, Maxwell's equations.	CO2
UNIT 3	Special Theory of Relativity: Introduction, Inertial frame of reference, Galilean transformations, Postulates, Lorentz transformations and its conclusions, Length contraction, time dilation, velocity addition, Mass change, Einstein's mass energy relation.	CO3
UNIT 4	Quantum Mechanics: Planck's theory of black-body radiation, Compton effect, Wave particle duality, De Broglie waves, Davisson and Germer's experiment, Uncertainty principle, physical interpretation of wave function, Schrodinger equation in one dimension, free particle, particle in an infinite square well.	CO4
UNIT 5	Lasers: Spontaneous and stimulated emission, Einstein's A and B coefficients, Population inversion, Light amplification, Basic laser action, Ruby and He-Ne lasers, Properties and applications of laser radiation, Elementary ideas of fiber optic cables	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text books:

- 1: A. Ghatak, Optics, 4th Edition, Tata Mcgraw Hill, 2009
- 2: Mathew N.O. Sadiku, Elements of Electromagnetics, Oxford University Press (2001)
- 3: Arthur Beiser, Concept of Modern Physics, 6th edition 2009, Tata McGraw- Hill

Reference books:

- 1: Fundamentals of Physics, Halliday, Walker and Resnick

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	1	-	-	1	-	-	-	-	2
CO3	3	2	1	1	-	-	1	-	-	-	-	2
CO4	3	1	-	-	-	-	-	-	-	-	-	1
CO5	3	2	1	1	-	-	-	-	-	-	-	2

Corporate Communications

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Corporate Communications
Course Code	
Credit	L-T-P- 2-0-0 Total Credit - 2
Course Type	HS
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none">1. To gain a comprehensive understanding of the principles, theories, and models underlying corporate communication practices in various organizational contexts2. To enhance oral, written, and digital communication skills essential for conveying corporate messages effectively,3. To critically evaluate real-world corporate communication strategies and campaigns, examining their effectiveness, ethical implications, and impact on stakeholders4. To analyze and solve communication challenges faced by corporations5. To explore the ethical dimensions and cultural nuances of corporate communication

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Demonstrate proficiency in crafting and delivering corporate messages across various communication channels, including written, verbal, and digital platforms.</p> <p>CO2. Analyze and evaluate the effectiveness of corporate communication strategies by applying theoretical frameworks and considering ethical and cultural factors.</p> <p>CO3. Develop comprehensive communication plans tailored to corporate objectives, incorporating audience analysis, message framing, and channel selection.</p> <p>CO4. Improve their interpersonal communication skills, including active listening, conflict resolution, and negotiation.</p> <p>CO5. Develop an awareness of ethical issues in corporate communication and cultivate professionalism in their interactions, demonstrating sensitivity to cultural diversity and ethical dilemmas.</p>
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Foundations of Corporate Communication</p> <p>1.1: Introduction to Corporate Communication Overview of corporate communication principles and theories: Organizational communication, Corporate Identity, and Reputation Management. Introduction to communication models like the Shannon-Weaver Model, Transactional Model, and Coordinated Management of Meaning (CMM) Historical evolution and current trends: Historical development of corporate communication from traditional forms to contemporary practices. Current trends such as Digital Transformation, Stakeholder Engagement, and Sustainability Communication.</p> <p>1.2: Communication Skills Development Writing effective corporate communications: crafting clear, concise, and professional written communication, including emails, memos, reports, and press releases. Oral communication skills development: Exercises to improve public speaking skills, Audience Analysis. Including structuring presentations, using visual aids effectively, and delivering persuasive speeches. Role-playing scenarios to enhance verbal communication in meetings, negotiations, and Foundations of Corporate Communication</p>	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

<p>UNIT 2</p>	<p>Analyzing Corporate Communication Strategies 2.1: Understanding Communication Strategies Models and frameworks for analyzing communication strategies: Exploration of theoretical frameworks such as the RACE model (Research, Action, Communication, Evaluation) and PESO model (Paid, Earned, Shared, Owned). Application of strategic communication planning tools like SWOT analysis, stakeholder mapping, and message mapping. 2.2: Case studies analysis Analysis of real-world corporate communication campaigns, including successful and unsuccessful examples. Identification of key elements such as objectives, target audience, messaging, channels, and evaluation metrics.</p>	<p>CO2</p>
<p>UNIT 3</p>	<p>Communication Ethics 3.1. Ethical dimensions in corporate communication Ethical principles: honesty, transparency, integrity, and accountability, in corporate communication. Ethical theories: Consequentialism, Deontology, Social Contract Theory 3.2: Ethical dilemmas Examination of ethical dilemmas faced by organizations through case studies</p>	<p>CO3</p>
<p>UNIT 4</p>	<p>Digital Communication and Interpersonal Skills 4.1: Digital Communication Strategies Role of digital communication and social media: Exploration of the impact of digital technologies and social media platforms on corporate communication practices. Developing social media strategies: Best practices for leveraging digital channels for brand building, and customer engagement, Planning and executing social media campaigns to achieve communication objectives, including content creation, community management, and performance measurement to LinkedIn. 4.2: Interpersonal Communication Skills Enhancing interpersonal communication skills: active listening, empathy, and nonverbal communication to improve interpersonal interactions in professional settings. Conflict resolution techniques: Strategies for identifying sources of conflict, facilitating constructive dialogue, and negotiating mutually acceptable solutions.</p>	<p>CO4</p>
<p>UNIT 5</p>	<p>Global Communication and Cultural Competence 5.1: Cultural Dimensions in Communication Understanding cultural nuances in communication: Cultural Dimensions, Cross-cultural communication etiquette, Cultural barriers and how to overcome them.</p>	<p>CO5</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text books:

1. Excellence in Public Relations and Communication Management; by James E. Grunig, Larissa A. Grunig, David M. Dozier, and Fred C. Repper. Routledge Abingdon, UK. 2013
2. Business Ethics: Ethical Decision Making & Cases; by O.C. Ferrell, John Fraedrich, and Linda Ferrell Cengage Learning Boston, MA, USA. 2018

Reference books:

3. Strategic Planning for Public Relations; by Ronald D. Smith. Routledge Abingdon, UK. 2019
4. Digital Marketing: Strategy, Implementation and Practice; by Dave Chaffey and Fiona Ellis-Chadwick. Pearson Harlow, UK. 2019
5. The Culture Map: Breaking Through the Invisible Boundaries of Global Business; by Erin Meyer. Public Affairs New York, NY, USA. 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	1	2	3	-	1
CO2	-	-	-	-	-	3	1	2	1	3	-	1
CO3	-	1	2	-	-	3	1	2	2	3	1	1
CO4	-	-	-	-	-	3	-	2	3	3	-	1
CO5	-	-	-	-	-	3	1	3	1	2	-	1

Design Thinking

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Design Thinking
Course Code	
Credit	L-T-P- 2-0-0 Total Credit - 2
Course Type	HS

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	<ol style="list-style-type: none"> 1. Inculcate the fundamental concepts of design thinking 2. Develop the students as a good designer by imparting creativity and problem solving ability 3. Conceive, conceptualize, design and demonstrate innovative ideas using prototypes
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Demonstrate the critical theories of design, systems thinking, and design methodologies</p> <p>CO2. Produce great designs, be a more effective engineer, and communicate with high emotional and intellectual impact</p> <p>CO3. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices</p> <p>CO4. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches.</p> <p>CO5. Demonstrate teamwork, ethical responsibility, and sustainability awareness in collaborative design projects, integrating reflective practices and effective communication.</p>

Unit	Description	CO Mapping
UNIT 1	<p>Introduction to Design Thinking: Definition and Principles, History and Evolution, Importance in Engineering and Computer Science</p> <p>Design Thinking Process: Empathize, Define, Ideate, Prototype, Test</p> <p>Empathize User Research Techniques, Interviews and Observations, Creating Empathy Maps</p>	CO1
UNIT 2	<p>Define: Problem Statement, Point of View (POV), Defining User Needs and Insights</p> <p>Ideate: Brainstorming Techniques, Creative Thinking, Idea Generation Tools</p> <p>Prototype: Prototyping Methods, Rapid Prototyping, Low-fidelity vs. High-fidelity Prototypes</p>	CO2
UNIT 3	<p>Test: Usability Testing, Gathering Feedback, Iterative Design</p>	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<p>Tools and Techniques: Software Tools (e.g., Sketch, Figma, Adobe XD), Physical Prototyping Tools, Storyboarding</p> <p>Application in Computer Science: Case Studies, Design Thinking in Software Development, User-Centered Design in Technology Projects</p>	
UNIT 4	<p>Teamwork and Collaboration: Collaborative Design Techniques, Team Dynamics and Roles, Communication Skills</p> <p>Real-world Projects: Project-based Learning, Industry Collaborations, Capstone Project</p> <p>Evaluation and Reflection: Reflective Practices, Self and Peer Assessment, Continuous Improvement</p>	CO4
UNIT 5	<p>Ethics and Social Responsibility: Ethical Considerations in Design, Impact of Design on Society, Sustainability in Design</p> <p>Final Project: Problem Identification, Design Process Documentation, Presentation and Demonstration</p>	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. IdrisMootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

Reference Books:

1. Brenda Laurel Design Research methods and perspectives MIT press 2003
2. Terwiesch, C. & Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard business press.
3. Ulrich &Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
4. Stuart Pugh, Total Design: Integrated Methods for Successful Product Engineering, BjarkiHallgrimsson, Prototyping and model making for product design, 2012, Laurence King Publishing Ltd
5. Kevin Henry, Drawing for Product designers, 2012, Laurence King Publishing Ltd

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	-	-	-	-	-	-	-	1
CO2	1	3	2	1	-	-	-	1	1	1	-	2
CO3	1	3	3	1	-	-	-	-	2	1	-	2
CO4	1	3	3	2	1	-	-	-	2	1	1	2
CO5	1	3	3	2	1	1	1	1	3	1	2	3

PRACTICAL/SESSIONAL

Data Structure Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Data Structure Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	PC
Course Objective	<ol style="list-style-type: none">1. Develop programs for performing different operations on Arrays, Stack, Queue, Linked list. Analyze the difference between them and understand different applications.2. Develop programs for understanding different searching and sorting methods and their applications.
Course Outcome (COs)	After the completion of this course, students will be able to CO1. Understand the basic concepts of data structures, remember the fundamental concepts. CO2. Understand the programming by comparing the types of data structures concepts. CO3. Develop the codes for implementing different operations on data structures. CO4. Analyses of the codes regarding different operations on data structures.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	CO5. Solve and evaluate complex problems by coding on linear and non-linear data structures. CO6. Design the codes on advanced concepts of data structure by implementation in different application of data structure.
--	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Experiment-1(functions and arrays)

Q1) Write a program to create an UDF for input 10 numbers into a 1D array. Create two functions MAX() and MIN(). MAX() is used to return the largest element and MIN() is used to return the smallest number in array.

Q2) Write a C program to create methods for operations insertion and display on 1D array of elements using UDF.

Q3) Write a C program to create methods for operations deletion, and display on 1D array of elements using UDF.

Experiment 2: (concepts of matrix and sparse matrix)

Q1) Write a C program to create function for performing matrix multiplication using UDF

Q2) Write a C program to input elements into a square matrix and display the transpose of it using UDF.

Q3) Write a program to input elements into a 4X4 matrix, check it for sparse or not. If sparse then store the non-zero elements into an alternate matrix and then display it using UDF.

Experiment 3: (Pointer, structure and DMA)

Q1) Write a program to store N numbers using dynamic memory allocation and then find the largest element using UDF.

Q2) Write a C program to create a structure called student to store your rollno, name, age. Create an array to input 5 students data and then create an UDF to display details where age \geq 20.

Q3) Write a program to create a structure for products of a super market. Store product no, name and cost for N products using dynamic memory allocation. Display the products whose cost is in between 100 rupees to 1000 rupees.

Experiment 4: (stack and queue)

Q1) Write a program using C to create a stack of numbers and perform using UDF:

(i) push operation (ii) pop operation (iii) display operation

Q2) Write a C program to create a linear queue and perform the following operations using UDF:
(i) insertion ii) deletion and iii) Traversal

Q3) Write a C program to create a circular queue and perform the following operations using UDF: (i) insertion ii) deletion and iii) Traversal

Experiment 5: (searching and sorting)

Q1) Write a program to implement binary search on array elements using UDF

Q2) write a program to implement selection sort on a given list of array elements.

Q3) Write a program to input a string and sort the alphabets in ascending order using bubble sort.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Experiment 6: (sorting and merging)

Q1) Write a program to input elements into two arrays A[5] and B[5]. Input the elements in ascending order and then merge their values into a resultant array C[10] in sorted manner using UDF.

Q2) Write a program to implement insertion sort on a given list of array elements.

Experiment 7 : (single linked list)

Q1) Write a C program to perform the operations on a single linked list:

i) Insertion at beginning, ii) Deletion of 1st node iii) display all nodes

Q2) Write a C program to perform the operations on a single linked list:

i) insertion at end, i) deletion of last node iii) display all the nodes

Q3) Write a C program to perform the operations on a single linked list:

i) insertion at location ii) searching for a node item iii) display all the nodes.

Experiment-8 : (linked stack and linked queue)

Q1) Write a C program that uses functions to implement linked stack on single linked list.

Q2) Write a C program that uses functions to implement linked queue on single linked list.

Experiment-9 (double linked list)

Q1) Write a C program to perform the operations on a single linked list:

i) Insertion at beginning, ii) Deletion of 1st node iii) display all nodes

Q2) Write a C program to perform the operations on a single linked list:

i) insertion at end, i) deletion of last node iii) display all the nodes

Experiment 10: (Advanced Programs using linked list)

Q1) Write a program to create a single linked list for storing the N cricket player details having member's player name, team name and batting average. Display only those players information whose batting average ≥ 50

Q2) Write a program to create a double linked list for storing account details of bank customers such as AC no, name, balance. Store details for N bank account holders and find the total balance for all account holders.

Topic Beyond Syllabus:

Q1) Write a C program to implement quick sort to a given list of integers to sort in ascending order.

Q2) Write a program to construction a Binary Search Tree for storing N unique numbers. Apply insertion(), deletion() and display() operation on it using UDF.

Q3) Write a program to create a connected graph when its adjacency list is given and display it.

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

1. "Fundamental of Data Structure" (Schaums Series) Tata-McGraw-Hill.
2. Pai: "Data Structures & Algorithms; Concepts, Techniques & Algorithms "Tata McGraw Hill.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

3. Gilberg and Forouzan: “Data Structure- A Pseudo code approach with C” by Thomson publication

Reference Books:

1. “Fundamentals of data structure in C” Horowitz, Sahani & Freed, Computer Science Press.
2. “Data Structures and algorithms” by Narasimha Karumanchi, CareerMonk Publications
3. “Data structures through C in depth” by S.K.Srivastava, BPB Publications

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	-	-	-	1
CO2	3	3	2	1	2	-	-	-	1	-	-	2
CO3	3	3	3	2	3	-	-	-	2	1	1	2
CO4	3	3	3	3	3	-	-	-	2	1	1	2
CO5	3	3	3	3	3	-	-	1	2	1	1	2
CO6	3	3	3	3	3	-	-	1	3	1	1	3

Basic Electronics Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Basic Electronics Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	ES
Course Objective	<p>This course enables the students</p> <ol style="list-style-type: none"> 3. To demonstrate the measurement of voltage, frequency using CRO 4. To explain PN junction characteristics and its applications. 5. To understand the frequency response of BJT amplifier and OPAMP. 6. To Realize logic gates and implement simple Boolean expression. 7. To explain the Amplitude Modulation and Frequency Modulation
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO7. Make use of CRO for measuring different parameters</p> <p>CO8. Appraise PN junction characteristics and its applications.</p> <p>CO9. Experiment with Diodes, BJT and OPAMP</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	CO10. Design specified circuit using given electronic components/ICs/logic gates. CO11. Demonstrate the working of Amplitude Modulation and Frequency Modulation.
--	----------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description
Lab 1	Measurement of voltage, time period and frequency of different signals on CRO. Measurement of frequency and phase of two different signals using Lissajous pattern.
Lab 2	To determine the forward and reverse bias characteristics of PN junction diode.
Lab 3	To determine the reverse bias characteristics of Zener diode and application as a voltage Regulator.
Lab 4	Measurement of rectification efficiency and ripple factor of Half-wave and Full-wave rectifier Circuits with and without C-Filter.
Lab 5	To determine the frequency response of CE transistor amplifier and finding its gain bandwidth product.
Lab 6	To determine the transfer characteristics of JFET and measurement of its voltage gain.
Lab 7	Design of RC phase shift oscillator using IC-741 Op-Amp and finding its frequency of oscillation.
Lab 8	Design of Inverting and Non-inverting amplifier using IC 741 OP-AMP and finding its frequency response.
Lab 9	Realization of Basic logic gates (AND, OR, NOT) using NAND Gate (IC-7400)
Lab 10	Implementation of Boolean expression $F = (A.B.C + D.E)$ using AND Gate(IC 7408) and OR Gate (IC 7432).
Lab 11	Generation of Amplitude modulated wave and calculation of percentage of modulation using standard setup
Lab 12	Generation of FM-wave and its detection using standard setup.

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

1. Millman J., Halkias C.C., Parikh Chetan, "Integrated Electronics: Analog and Digital Circuits and Systems", Tata McGraw-Hill, 2/e.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

2. Mano M.M., “Digital Logic and Computer Design”, Pearson Education, Inc, Thirteenth Impression, 2011.
3. Singal T. L., “Analog and Digital Communications”, Tata McGraw-Hill, 2/e.
4. Haykin S., Moher M., “Introduction to Analog & Digital Communications”, Wiley India Pvt. Ltd., 2/e.

Reference Book:

1. Boylstead R.L., Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson Education, Inc,

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3	-	-	-	1	-	-	1
CO2	3	3	2	2	3	-	-	-	2	-	-	2
CO3	3	3	2	2	3	-	-	-	1	-	-	2
CO4	3	2	1	2	3	-	-	-	1	-	-	1
CO5	1	1	1	1	1	-	-	1	2	3	1	1

Corporate Communication Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	II
Course Title	Corporate Communications Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	HS
Course Objective	<p>This course enables the students to understand</p> <ol style="list-style-type: none"> 1. To gain a comprehensive understanding of the principles, theories, and models underlying corporate communication practices in various organizational contexts 2. To enhance oral, written, and digital communication skills essential for conveying corporate messages effectively, 3. To critically evaluate real-world corporate communication strategies and campaigns, examining their effectiveness, ethical implications, and impact on stakeholders 4. To analyze and solve communication challenges faced by corporations

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	5. To explore the ethical dimensions and cultural nuances of corporate communication
Course Outcome (COs)	<p>After the completion of this course, students will be able to</p> <p>CO1. Demonstrate proficiency in crafting and delivering corporate messages across various communication channels, including written, verbal, and digital platforms.</p> <p>CO2. Analyze and evaluate the effectiveness of corporate communication strategies by applying theoretical frameworks and considering ethical and cultural factors.</p> <p>CO3. Develop comprehensive communication plans tailored to corporate objectives, incorporating audience analysis, message framing, and channel selection.</p> <p>CO4. Improve their interpersonal communication skills, including active listening, conflict resolution, and negotiation.</p> <p>CO5. Develop an awareness of ethical issues in corporate communication and cultivate professionalism in their interactions, demonstrating sensitivity to cultural diversity and ethical dilemmas.</p>

Course Outline

Lab	ACTIVITIES TO BE COVERED
LAB 1	<p>Cover Letter Writing</p> <ul style="list-style-type: none"> • Introduction to the importance of cover letters in job applications. • Components of a cover letter: introduction, body, conclusion. • Analyzing sample cover letters. • Interactive session: students draft their cover letters. • Peer review and feedback.
LAB 2	<p>CV/Resume Building</p> <ul style="list-style-type: none"> • Understanding the purpose and structure of a CV/resume. • Crafting impactful CV/resume content: education, work experience, skills, achievements. • Design and formatting tips. • Hands-on activity: students create their CVs/resumes using templates or online tools.
LAB 3	<p>Group Discussion Skills</p> <ul style="list-style-type: none"> • Importance of group discussions in the selection process. • Strategies for effective participation: active listening, articulation, persuasion. • Handling different types of GD topics: abstract, case-based, and opinion-based. • Conducting mock group discussions.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<ul style="list-style-type: none"> •Peer evaluation and feedback on performance.
LAB 4	Verbal Ability Enhancement <ul style="list-style-type: none"> •Vocabulary-building exercises: synonyms, antonyms, word roots. •Grammar and sentence structure practice. •Interactive games and quizzes to reinforce verbal ability concepts
LAB 5	Verbal Ability Enhancement (CONT...) <ul style="list-style-type: none"> •Vocabulary-building exercises: synonyms, antonyms, word roots. •Grammar and sentence structure practice. •Interactive games and quizzes to reinforce verbal ability concepts
LAB 6	Mock Interview Preparation (Part 1) <ul style="list-style-type: none"> •Types of interviews: behavioral, competency-based, situational. •Understanding common interview questions and how to answer them. •Conducting practice interviews •Feedback on interview performance and areas for improvement.
LAB 7	Integration and Practice <ul style="list-style-type: none"> •Integrating cover letter writing, CV/resume building, group discussion, mock interview, and verbal ability skills. •Practical exercises combining multiple skills: e.g., conducting a mock interview based on a job posting, followed by group discussion and feedback. •Individualized coaching sessions for refining specific skills. •Final review and assessment of progress made throughout the lab.
LAB 8	Review and Wrap-Up <ul style="list-style-type: none"> •Recap of key learnings and skills acquired. •Opportunities for additional practice and skill development. •Q&A session to address any remaining doubts or questions. •Distribution of certificates of completion. •Encouragement for ongoing self-improvement and professional development.

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text books:

1. Excellence in Public Relations and Communication Management; by James E. Grunig, Larissa A. Grunig, David M. Dozier, and Fred C. Repper. Routledge Abingdon, UK. 2013
2. Business Ethics: Ethical Decision Making & Cases; by O.C. Ferrell, John Fraedrich, and Linda Ferrell Cengage Learning Boston, MA, USA. 2018

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Reference books:

3. Strategic Planning for Public Relations; by Ronald D. Smith. Routledge Abingdon, UK. 2019
4. Digital Marketing: Strategy, Implementation and Practice; by Dave Chaffey and Fiona Ellis-Chadwick. Pearson Harlow, UK. 2019
5. The Culture Map: Breaking Through the Invisible Boundaries of Global Business; by Erin Meyer. Public Affairs New York, NY, USA. 2014

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	-	1	2	3	-	1
CO2	-	1	1	-	-	3	1	2	2	3	-	1
CO3	-	1	2	-	-	3	1	2	3	3	1	1
CO4	-	-	-	-	-	3	-	2	3	3	-	1
CO5	-	-	-	-	-	3	1	3	2	3	-	1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

SECOND YEAR

Discrete Mathematics

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Discrete Mathematics
Course Code	
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	
Course Objective	The subject aims to provide the student with: CO1. To introduce the concepts of mathematical logic CO2. To introduce the concepts of sets, relations, and functions. CO3. To perform the operations associated with sets, functions, and relations. CO4. To introduce generating functions and recurrence relations. CO5. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context. To use Graph Theory for solving problems
Course Outcome (COs)	At the end of the course, the students will be able to CO1: Understand set and set relation mathematical terminology and notation. CO2: Construct direct, and indirect, proofs of basic theorems. CO3: Understand the differences between a mathematical proof, a heuristic, and a conjecture. CO4: Learn how to divide a problem, or a proof, into smaller cases. CO5: Formulate mathematical claims and be able to construct counterexamples.

Course Outline

Unit	Description	CO Mapping
UNIT 1	Set, Relations, Functions Set, Relations, Functions. Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	uncountable Sets, Cantor's diagonal argument and The Power Set theorem.	
UNIT 2	Proof strategies and Proof Methods Proof strategies. Proof Methods and Strategies: Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency, Case analysis, Induction. Modular Arithmetic. Extended Euclid's Greatest Common Divisor algorithm, The Fundamental Theorem of Arithmetic, Modular arithmetic, Coprimality (or Euler's totient function), Chinese Remainder	CO2
UNIT 3	Combinatorics Combinatorics. Permutation & Combination, Inclusion-Exclusion, Pigeon-hole principle, Graphs. Connected components, Paths, Cycles, Trees, Hamiltonian/ Eulerian Walks, Colouring, Planarity, Matching.	CO3
UNIT 4	Logic Logic Languages of Propositional logic and First-order logic, expressing natural language sentences in languages of propositional and first-order logic, expressing natural language predicates in the language of first-order logic. Semantics of First order logic: interpretation and its use in evaluating a formula. Optional advanced topics if there is extra time: Semantic entailment, Validity and Satisfiability. What is a proof system? E.g. natural deduction or analytical tableau. Notions of Consistency and Completeness of a logic.	CO4
UNIT 5	Algebra Algebra. Group, Permutation Groups, Cosets, Normal Subgroups, Ring, Field, Finite fields, Fermat's little theorem, Homomorphisms, Isomorphisms. Discrete probability. Topics to be taught from the viewpoint of CS instead of Maths: Discrete Sample Space, Probability Distribution, Random variables, Expectation, Variance, Bernoulli trials, Conditional probability & independence (Bayes' Theorem).	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1. Singh, S.B., Discrete Mathematics, Khanna Book Publishing Company, New Delhi.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

T2. Liu, C. L., & Mohapatra, D. P. (2008). Elements of Discrete Mathematics. Tata McGraw-Hill.

T3. Rosen, K. H. (2019). Discrete Mathematics and Its Applications. (8th Edition) ISBN10: 125967651X

ISBN13: 9781259676512.

T4. Huth, M., & Ryan, M. (2004). Logic in Computer Science: Modelling and Reasoning about Systems (2nd ed.). Cambridge University Press.

T5. Cohen, D. I. A. (1978). Basic techniques of combinatorial theory. John Wiley.

Reference Books:

R1. Norman L. Biggs, Discrete Mathematics, (2nd ed. 2002), Oxford University Press.

R2. Smullyan, R. M. (1995). First-order logic. Courier Corporation.

R3. Bóna, M. (2006). A walk through combinatorics: an introduction to enumeration and graph theory.

R4. Cameron, P. J. (1994). Combinatorics: topics, techniques, algorithms. Cambridge University Press.

R5. Shoup, V. (2009). A computational introduction to number theory and algebra. Cambridge University Press.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1
CO3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	2	1	1	-	-	-	-	-	-	-	1
CO5	3	3	2	2	-	-	-	-	-	-	-	2

Database Management Systems

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Database Management Systems
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve efficiently and effectively information from a DBMS.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1: Design and implement database schema for an application using RDBMS concepts.</p> <p>CO2: Write SQL queries for tasks of various complexities.</p> <p>CO3: Write an application program that uses a database system as the backend.</p> <p>CO4: Understand the internal working of a DBMS including data storage, indexing, query processing, transaction processing, and concurrency control and recovery mechanisms.</p> <p>CO5: Aware of non-relational and parallel/distributed data management systems with a focus on scalability.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	Introduction Introduction (i) Motivation (ii) Introduction to Data Models (Relational, Semi structured, ER) Relational Databases (i) Relational Data Model (ii) Relational Algebra (iii) Relational Calculus or Connection to First Order Logic (Optional)	CO1
UNIT 2	Data Definition Language (i) DDL (ii) Insert/Delete/Update (i) Laboratory exercises where students write SQL queries for various tasks. Interacting with database (iii) Simple Queries (select/project/join/ aggregate queries) (iv) Complex queries (With Clause, Nested Sub queries, Views) (v) Programming in a standard language and interfacing with a DB backend Platform can be PostgreSQL preferably, or MySQL.	CO2
UNIT 3	Key-value Stores Big Data Key-value Stores and Semi structured Data, using JSON and MongoDB, or other combinations (i) Small exercises on MongoDB Database Design (i) Introduction to ER model (ii) Mapping from ER to relational model (iii) Functional Dependencies (iv) Normalization (BCNF, Optionally 3NF) (i) Exercise in ER design for an application starting with natural language description (ii) Convert ER design to tables (iii) Pen-and-paper exercises with FDs and normalization	CO3
UNIT4	Physical Design	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Physical Design (i) Overview of Physical Storage (Hard Disks, Flash/SSD/RAM), sequential vs random I/O, Reliability via RAID (ii) Storage Organization (Records, Pages and Files), Database Buffers, Database Metadata (iii) Indexing, B+-Trees (i) Use a B+-tree visualization system to understand how B+- trees work , Query Processing and Optimization (i) Query Processing: External sort, Joins using nested loops, indexed nested loops (ii) Overview of Query Optimization: equivalent expressions, and concept of cost based optimization (i) Examine query plans for sample queries	
UNIT5	Transaction Processing Transaction Processing (i) Concept of transactions and schedules, ACID properties (ii) Conflict-serializability (iii) Concurrency control: locks, 2PL, Strict 2PL, optional: isolation levels (iv) Recovery using undo and redo logs (i) Pen-and-paper exercises on conflicts, cycles, conflict serializability, recoverability, etc.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

- T1. Database System Concepts, 7th Edition, Silberschatz, Korth and Sudarshan, McGraw-Hill Indian Edition released 2021
- T2. Fundamentals of Database Systems, 7th Edition, Elmasri and Navathe, Pearson Pubs, 2017
- T3. Principles of Database Management, Lemahieu, Broucke and Baesens, Cambridge University Press, 2018
- T4. Database Management Systems, RP Mahapatra, Khanna Publishing House, 2020.
- T5. Database Management Systems, Krishnan, McGraw Hill.

Reference Books:

- R1: Relax Relational algebra calculator: <https://dbis-uibk.github.io/relax/landing>
- R2: SQL: PostgreSQL/MySQL/MariaDB, or SQLite in browser
- R3: B+-tree visualization: <https://www.cs.usfca.edu/~galles/visualization/BPlusTree.html>
- R4: MongoDB: Various DB systems playground: <https://www.pdbmbook.com/playground>

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	1	2
CO2	3	3	3	2	-	-	-	-	-	-	-	1
CO3	3	3	3	2	1	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	1	1	1	2	-	-	-	-	-	1	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Digital System Design

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Digital System Design
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	<ol style="list-style-type: none">1. To understand common forms of number representation in logic circuits2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.3. To understand the concepts of combinational logic circuits and sequential circuits.4. To understand the Realization of Logic Gates Using Diodes & Transistors.
Course Outcome (COs)	<p>At the end of the course, the students will be able to:</p> <p>CO1: Understand the numerical information in different forms and Boolean Algebra theorems</p> <p>CO2: Postulates of Boolean algebra and to minimize combinational functions</p> <p>CO3: Design and analyse combinational and sequential circuits</p> <p>CO4: Analyze and explain uses of small- and medium-scale logic functions as building blocks.</p> <p>CO5: Known about the logic families and realization of logic gates.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	Number Systems: Number systems, Complements of Numbers, Codes- Weighted and Non-weighted codes and its Properties, Parity check code and Hamming code. Boolean Algebra: Basic	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Theorems and Properties, Switching Functions- Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.	
UNIT 2	Minimization of Boolean functions: Karnaugh Map Method – Up to five Variables, Don't Care Map Entries, Tabular Method, Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.	CO2
UNIT 3	Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Registers and Counters: Shift Registers – Left, Right and Bidirectional Shift Registers, Applications of Shift Registers – Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.	CO3
UNIT 4	Sequential Machines: Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters. Finite state machine-capabilities and limitations, Mealy and Moore models.	CO4
UNIT 5	Realization of Logic Gates Using Diodes & Transistors: AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate- Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri- state outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Text Books:

T1: Switching and Finite Automata Theory – Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.

T2: Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill

T3: Digital Design- Morris Mano, PHI, 4th Edition, 2006.

T4: Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.

Reference Books:

R1: Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.

R2: Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	3	2	-	-	-	-	-	-	-	2
CO4	3	2	1	2	-	-	-	-	-	-	-	1
CO5	3	1	1	-	-	-	-	-	-	-	-	1

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	OBJECT ORIENTED PROGRAMMING THROUGH JAVA
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Type	
Course Objective	The course aims to introduce the fundamental concepts of Object-Oriented programming, design & implement object oriented programming concepts in Java.
Course Outcomes (COs)	<p>At the end of the Course the student shall be able to:</p> <p>CO1: Implement object orientated programming strategies and Contrast classes and objects.</p> <p>CO2: Analyze Inheritance and Dynamic Method Dispatch.</p> <p>CO3: Demonstrate various classes in different packages and can design own packages.</p> <p>CO4: Manage Exceptions and Apply Threads.</p> <p>CO5: Create GUI screens along with event handling and write network programs.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	INTRODUCTION TO OBJECTS & CLASSES: What is Object Oriented Programming? Object Orientation as a New Paradigm: An Overview of Java: Process Oriented Vs Object Oriented Programming, OOP Principles, Java Buzz Words, The Byte Code, A First Simple Program. Class Fundamentals with Variables and Methods, Declaring objects for accessing variables and methods. Data Types and Variables, Operators and Expressions, Control Statements, Type Conversion and casting. Arrays: Single Dimension, command line arguments, Arrays: Multi Dimension. Constructors: Default and Parameterized, this keyword and Garbage Collection, Final and Static Keywords, Overloading Methods, Overloading Constructors, Using objects as Parameters, Returning objects, String and String Buffer	CO1
UNIT 2	INHERITANCE: Inheritance Basics, Types of Inheritance, Using Super keyword for constructors, Super to call variables and methods, Method Overriding, Dynamic Method Dispatch Learning Outcomes:	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT 3	PACKAGES AND INTERFACES: Defining a Package, importing a package, Package Example, Access Protection, An Access Example, Abstract classes, Interfaces: Defining and Implementing Interfaces EXPLORING java. Lang: Wrapper classes, Object, Math, Runtime EXPLORING java.util: The collection framework: Array List, Hash Set and Hash Map, StringTokenizer, Calendar, Random, Scanner EXPLORING java.io: File class, Byte Streams, Character Streams, File Input Stream, FileOutputStream, File Reader and File Writer	CO3
UNIT 4	EXCEPTION HANDLING: Exception Handling Fundamentals, Exception Types, throw, throws and finally, Creating your own exceptions, Chained Exceptions. MULTITHREADED PROGRAMMING: Java Thread Model, The Main thread, Two ways of Creating a Thread, Creating Multiple Threads, isAlive(),join(), Synchronization, Inter Thread	CO4
UNIT 5	INTRODUCING GUI PROGRAMMING WITH SWINGS: Swing Features, MVC Connection, Components and Containers, Panes, Simple Swing Application, Simple Swing Applet, Layout Managers: Flow, Border, Card, Grid, Grid Bag, Working with Color, Working with Fonts, Painting in Swing, Exploring Swing Components DELEGATION EVENT MODEL: Event Classes, Sources and Listeners. EXPLORING JAVA.NET: Socket, ServerSocket, InetAddress, DatagramSocket, URL, ClientServer Program using Sockets	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Multi-robot cooperation and path planning for stick transporting using improved Q-learning and democratic robotics PSO

Text Books:

- T1. Herbert Schildt, Java The complete reference, 11th Edition, McGraw-Hill, 2019
 T2. Timothy budd, An introduction to object-oriented programming, 3rd Edition, Pearson, 2009.

Reference Books:

- R1. Cay S. Horstmann, Core Java Volume I–Fundamentals, 11th Edition, Pearson 2019

B.TECH IN COMPUTER SCIENCE & ENGINEERING

R2. Y. Daniel Liang Introduction to Java Programming Comprehensive Version, 10th Edition, Pearson, 2015.

R3. Bruce Eckel, Thinking in Java, 4th Edition, Prentice Hall, 2006

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	-	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	1
CO3	3	3	3	2	1	-	-	-	-	-	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	3	2	1	-	-	-	-	-	-	2

Computer Network

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Computer Network
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	This course introduces students to the fundamental principles of computer networks and to their use in the Internet and motivates students with familiar uses and problems of their digital world and enables them to work with real-world applications from early in the course.
Course Outcome (COs)	At the end of the course the student shall: CO1: Understand the architecture principles that have enabled the orders of magnitude expansion of the internet. CO2: Analysed networked applications and their protocols, their installation, operation and performance tuning. CO3: Demonstrate layering as a means of tackling complexity, layering applied to the Internet. CO4: Understand protocols as a structured means of reliable communications.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	CO5: Be conversant with network programming using the socket API and tools for configuring, monitoring and tuning the Internet and hosts.
--	-------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Introduction to the Internet Overview</p> <p>Introduction to the Internet Overview of how the Internet works. Understand at a high level what happens when we browse a website. Understand basic terminology like browser, web server, URL, domain name, IP address, packets. Overview of the design principles of the Internet: packet switching vs circuit switching, store-and forward networks, layering for modularity. Introduction to the various layers in the Internet. Introduction to performance metrics like end-to-end throughput, delay, jitter and drop rates in a network. Statement of Little's Law. How performance is measured</p>	CO1
UNIT 2	<p>Application layer</p> <p>Application layer - Internet names, how DNS works. - Application layer protocols: HTTP, SMTP, SNMP, web applications.- Peer-to-peer applications. P2P file distribution. Audio and video streaming. Challenges of streaming over best effort IP. Linux Network Programming - Introduction to socket programming in Linux. Understand how to build a simple client-server application using TCP/UDP sockets.</p>	CO2
UNIT 3	<p>Transport Layer</p> <p>Transport Layer Importance of the transport layer; end-to-end principle. Transport layer protocols: basics of TCP and UDP, process-to process delivery, multiplexing, port numbers, and header structure. Reliable transmission of packets over an unreliable network: sequence numbers, ACKs, timeout, retransmissions. Stop and wait, and sliding window. - TCP connection setup and teardown. Flow control and congestion control at the transport layer. Differences between the two. Overview of TCP congestion control: Slow start and reaction to timeouts TCP congestion control: Slow start; congestion avoidance using loss-based and delay-based control</p>	CO3
UNIT 4	<p>The IP Layer</p> <p>The IP Layer Network architecture and performance Network topology; Router architecture: queuing and switching.</p>	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Performance evaluation of a network link: traffic characteristics, performance Measures, IP Protocol Need for an Internet address, and its design. Hierarchical IP addressing, IPv4 and IPv6, structure of IP datagram, IP forwarding. - NATs, security attacks and defences: DMZ firewalls. Routing protocols and Internet architecture Routing protocols: Link state routing. Distance vector routing: count-to-infinity, routing convergence. Understand the structure of the Internet: end-user organizations and ISPs. Understand the difference between intra-domain (OSPF) and inter-domain (BGP) routing. Intra-domain routing: OSPF.	
UNIT 5	Data Link Layer Mechanisms for error detection/recovery: Parity checks, CRC Medium access protocols: Polling vs. contention-based: TDM, Aloha, CSMA/CD Switched LANs: L2 addressing and ARP, Ethernet frame structure, learning switches. Wireless Networks Wireless physical layer: signal to- noise ratio, bit error rate, modulation, multipath, interference Wireless LANs: 802.11 architecture (access points, SSID, channels, beacons, scanning, association), 802.11 CSMA-CA protocol; summary of 802.11 variants	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

- T1. J.F. Kurose and K.F. Ross, Computer networking: a top-down approach, 6th edition, Pearson, 2017. (6th edition is low-cost Indian edition. 7th edition is high-cost, may be used if available).
- T2. Bhavneet Sidhu, an Integrated Approach to Computer Networks, Khanna Publishing House, 2021.

Reference Books:

- R1. R. Jain, The art of computer systems performance analysis, Wiley India, 1991.
- R2. S.K. Bose, an Introduction to Queuing Systems, Springer Science + Business Media New York, 2012.
- R3. A.S. Tanenbaum and D.J. Wetherall, Computer Networks, 5th edition, Pearson, 2013.
- R4. Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, 6th Edition

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	3	3	2	3	-	-	-	-	-	-	2

PRACTICAL / SESSIONAL Database Management Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Database Management Systems Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	
Course Objectives	The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve efficiently and effectively information from a DBMS.
Course Outcome (COs)	Upon completion of the course, the students will be able to CO1: Develop database modelling for a problem. CO2: Design a database using normalization. CO3: Implement a data base query language. CO4: Develop GUI using front end tool. CO5: Develop a connection between frontend and database and Implement a Data Manipulation Language.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description
Lab 1	Data Definition, Manipulation of base tables and views
Lab 2	Design a Database and create required tables. For e.g. Bank, College Database
Lab 3	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
Lab 4	Write a sql statement for implementing ALTER,UPDATE and DELETE
Lab 5	Write the queries to implement the joins
Lab 6	Write the query for implementing the following functions: MAX(),MIN(),AVG(),COUNT()
Lab 7	Write the query to implement the concept of Integrity constraints
Lab 8	Write the query to create the views
Lab 9	Write code for High level programming language extensions.
Lab 10	Code on Front end tools.
Lab 11	Perform the queries for triggers
Lab 12	Perform the following operation for demonstrating the insertion , updation and deletion using the referential integrity constraints
Lab 13	Write the query for creating the users and their role.

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

T1. Database System Concepts, 7th Edition, Silberschatz, Korth and Sudarshan, McGraw-Hill Indian Edition released 2021

T2. Fundamentals of Database Systems, 7th Edition, Elmasri and Navathe, Pearson Pubs, 2017

B.TECH IN COMPUTER SCIENCE & ENGINEERING

T3. Principles of Database Management, Lemahieu, Broucke and Baesens, Cambridge University Press, 2018

T4. Database Management Systems, RP Mahapatra, Khanna Publishing House, 2020.

T5. Database Management Systems, Krishnan, McGraw Hill.

Reference Books:

R1: Relax Relational algebra calculator: <https://dbis-uibk.github.io/relax/landing>

R2: SQL: PostgreSQL/MySQL/MariaDB, or SQLite in browser

R3: B+-tree visualization: <https://www.cs.usfca.edu/~galles/visualization/BPlusTree.html>

R4: MongoDB: Various DB systems playground: <https://www.pdbmbook.com/playground>

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	1	-	-	-	1
CO2	3	3	3	2	1	-	-	-	-	-	-	1
CO3	3	3	3	1	3	-	-	-	-	-	-	1
CO4	3	3	3	1	3	-	-	-	-	-	-	2
CO5	3	3	3	2	3	-	-	1	-	-	-	2

Digital System Design Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Digital System Design Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	
Course Objective	<ol style="list-style-type: none"> 1. To understand common forms of number representation in logic circuits. 2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems. 3. To understand the concepts of combinational logic circuits and sequential circuits. 4. To understand the Realization of Logic Gates Using Diodes & Transistors.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outcome (COs)	CO1: Construct digital circuit to examine Boolean algebra, truth table of different logic gates. CO2: Design various combinational and sequential circuits after analysing their timing properties. CO3: Demonstrate digital circuits using VHDL and other software. CO4: Analyze and explain uses of small- and medium-scale logic functions as building blocks. CO5: Known about the logic families and realization of logic gates.
-----------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description
Lab 1	Introduction to Digital Electronics Lab- Nomenclature of Digital Ics, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs
Lab 2	Implementation of the Given Boolean Function using Logic Gates in Both Sop and Pos Forms.
Lab 3	Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
Lab 4	Implementation and Verification of Decoder/De-Multiplexer and Encoder using Logic Gates.
Lab 5	Implementation of 4x1 multiplexer using Logic Gates.
Lab 6	Implementation of 4-Bit Parallel Adder Using 7483 IC.
Lab 7	Design, and Verify the 4- Bit Synchronous Counter
Lab 8	Design, and Verify the 4-Bit Asynchronous Counter.
Lab 9	Simulation of MOS Inverter with different loads using PSPICE software 10.
Lab 10	Simulation of CMOS Inverter for different parameters Kn, Kp as a design variable in suitable circuit simulator software.
Lab 11	Design of a 4-bit Multiplexer using VHDL\Verilog
Lab 12	Design of a decade counter using VHDL\Verilog.
Lab 13	Design of a 3-input NAND gate and its simulation using suitable logic simulator

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

1. Switching and Finite Automata Theory – Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd Edition, 2007- Tata McGraw-Hill
3. Digital Design- Morris Mano, PHI, 4th Edition, 2006.
4. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.

Reference Books:

R1: Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.

R2: Switching Theory and Logic Design – A Anand Kumar, PHI, 2013.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	2	-	-	1	-	-	-	1
CO2	3	3	3	2	3	-	-	1	-	-	-	2
CO3	3	2	3	2	3	-	-	1	1	-	-	2
CO4	2	3	3	2	2	-	-	1	-	-	-	2
CO5	1	2	1	1	2	-	-	1	1	-	-	2

Object Oriented Programming Using Java lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	III
Course Title	Object Oriented Programming Using Java lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objectives	The course aims to introduce the fundamental concepts of Object-Oriented programming, design & implement object oriented programming concepts in Java.
Course Outcomes (COs)	Upon completion of the course, the students will be able to CO1: Develop and implement Java programs for simple applications that make use of classes, packages and interfaces. CO2: Develop and implement Java programs with array list, exception handling and multithreading. CO3: Design applications using file processing, CO4: Demonstrate generic programming CO5: Apply the concept of event handling.

Course Outline

Unit	Description
Lab 1	Program to define a structure of a basic JAVA program.
Lab 2	Program to define the data types, variable, operators, arrays and control structures.
Lab 3	Program to define class and constructors. Demonstrate constructors.
Lab 4	Program to define class, methods and objects. Demonstrate method overloading.
Lab 5	Program to define inheritance and show method overriding.
Lab 6	Program to demonstrate Packages.
Lab 7	Program to demonstrate Exception Handling.
Lab 8	Program to demonstrate Multithreading.
Lab 9	Program to demonstrate I/O operations.
Lab 10	Program to demonstrate Network Programming.
Lab 11	Design of a 4-bit Multiplexer using VHDL\Verilog
Lab 12	Program to demonstrate Applet structure and event handling.
Lab 13	Program to demonstrate Layout managers.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

- T1. Herbert Schildt, Java The complete reference, 11th Edition, McGraw-Hill, 2019
T2. Timothy Budd, An introduction to object-oriented programming, 3rd Edition, Pearson, 2009.

Reference Books:

- R1. Cay S. Horstmann, Core Java Volume I–Fundamentals, 11th Edition, Pearson 2019
R2. Y. Daniel Liang Introduction to Java Programming Comprehensive Version, 10th Edition, Pearson, 2015.
R3. Bruce Eckel, Thinking in Java, 4th Edition, Prentice Hall, 2006

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	-	-	-	-	-	-	1
CO2	3	3	3	2	2	-	-	-	-	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	-	1
CO4	3	3	2	1	1	-	-	-	-	-	-	1
CO5	3	3	3	2	2	-	-	-	-	-	-	1

Fourth Semester

Programming Paradigm using Python

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Programming Paradigm using Python

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	<p>The course will enable students to:</p> <ol style="list-style-type: none"> 1. Learn the syntax and semantics of Python Programming Language 2. Write Python functions to facilitate code reuse and manipulate strings. 3. Illustrate the process of structuring the data using lists, tuples and dictionaries. 4. Demonstrate the use of built-in functions to navigate the file system. 5. Appraise the need for working on web scraping
Course Outcome (COs)	<p>Upon successful completion of this course, student will be able to</p> <p>CO1: Demonstrate the concepts of control structures in Python. CO2: Implement Python programs using functions and strings. CO3: Implement methods to create and manipulate lists, tuples and dictionaries. CO4: Apply the concepts of file handling and regEx using packages. CO5: Illustrate the working of scraping websites with CSV.</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Introduction</p> <p>Introduction, Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program. Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit().</p>	CO1
UNIT 2	<p>Functions</p> <p>Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling. Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods.</p> <p>Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things. Manipulating Strings - Working with Strings, Useful String Methods</p>	CO2
UNIT 3	<p>Pattern Matching with Regular Expressions</p>	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Pattern Matching with Regular Expressions: Finding Patterns of Text without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Nongreedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re.IGNORECASE, re .DOTALL, and re .VERBOSE.	
UNIT 4	Files Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint.pformat() Function. Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile	CO4
UNIT 5	Web Scraping Web Scraping: Project: MAPIT.PY with the web browser Module, Downloading Files from the Web with the requests Module, Saving Downloaded Files to the Hard Drive, HTML. Working with Excel Spreadsheets: Excel Documents, Installing the openpyxl Module, Reading Excel Documents, Project: Reading Data from a Spreadsheet, Writing Excel Documents, Project: Updating a Spreadsheet, Setting the Font Style of Cells, Font Objects, Formulas, Adjusting Rows and Columns,	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: Al Sweigart, “Automate the Boring Stuff with Python”, William Pollock, 2015, ISBN: 978-1593275990

Reference Books:

R1: Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.

R2: Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.

R3: Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

R4: Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, “Data Structures and Algorithms in Python”, 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.

R5: Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2
CO4	3	2	3	2	3	-	-	-	-	-	-	1
CO5	3	3	2	2	3	1	-	-	-	-	-	2

Computer Organization & Architecture

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Computer Organization & Architecture
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	To expose the students to the following: 1. How Computer Systems work & the basic principles 2. Instruction Level Architecture and Instruction Execution 3. The current state of art in memory system design 4. How I/O devices are accessed and its principles. 5. To provide the knowledge on Instruction Level Parallelism
Course Outcome (COs)	Upon successful completion of this course, student will be able to CO1: Demonstrate the key components of a basic computer. CO2: Understand the key components of a CPU and how the instructions are executed. CO3: Implement the pipelined processor to understand the execution and time taken by instructions.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<p>CO4: Analyse the need for memory hierarchy and efficiency achieved due to the use of cache.</p> <p>CO5: understand the data storage and input-output operation performed in computers.</p>
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Introduction</p> <p>Introduction Role of abstraction, basic functional units of a computer, Von-Neumann model of computation, A note on Moore's law, Notion of IPC, and performance. Data representation and basic Operations.</p>	CO1
UNIT 2	<p>Instruction Set Architecture</p> <p>Instruction Set Architecture (RISC-V) CPU registers, instruction format and encoding, addressing modes, instruction set, instruction types, instruction decoding and execution, basic instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer</p>	CO2
UNIT 3	<p>The Processor</p> <p>The Processor Revisiting clocking methodology, Amdahl's law, Building a data path and control, single cycle processor, multi-cycle processor, instruction pipelining, Notion of ILP, data and control hazards and their mitigations.</p>	CO3
UNIT 4	<p>Memory hierarchy</p> <p>Memory hierarchy SRAM/DRAM, locality of reference, Caching: different indexing mechanisms, Trade-offs related to block size, associativity, and cache size, Processor-cache interactions for a read/write request, basic optimizations like write through/ write-back caches, Average memory access time, Cache replacement policies (LRU), Memory interleaving.</p>	CO4
UNIT 5	<p>Storage and I/O</p> <p>Storage and I/O Introduction to magnetic disks (notion of tracks, sectors), flash memory. I/O mapped, and memory mapped I/O. I/O data transfer techniques: programmed I/O, Interrupt-driven I/O, and</p>	CO5

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	DMA. Superscalar processors and multicore systems Limits of ILP, SMT processors, Introduction to multicore systems and cache coherence issues.	
--	------------------------------------------------------------------------------------------------------------------------------------------------	--

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: “Computer Organization and Design: The Hardware/Software Interface”, David A.Patterson and John L. Hennessy, 5th Edition, Elsevier

Reference Books:

R1: “Computer Organisation & Architecture”, Smruti Ranjan Sarangi, McGraw Hill

R2: “Computer System Architecture”, Mano M. Morris, Pearson.

R3: “Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraHill
Higher Education

R4: “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill

R5: “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	2
CO4	3	3	2	2	-	-	-	-	-	-	1	2
CO5	3	2	1	-	-	-	-	-	-	-	-	1

Design and Analysis of Algorithms

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Design and Analysis of Algorithms
Course Code	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	The primary objective of this course is to introduce the concept of algorithm as a precise mathematical concept, and study how to design algorithms, establish their correctness, study their efficiency and memory needs.
Course Outcome (COs)	At the end of this course students will be able to CO1: Identify various Time and Space complexities of various algorithms CO2: Understand Tree Traversal method and Greedy Algorithms CO3: Apply Dynamic Programming concept to solve various problems CO4: Apply Backtracking, Branch and Bound concept to solve various problems CO5: Implement different performance analysis methods for non-deterministic algorithms.

Course Outline

Unit	Description	CO Mapping
UNIT 1	Introduction Algorithm, pseudo code for expressing algorithms, performance analysis-space complexity, time complexity, asymptotic notation-big (O) notation, omega notation, theta notation and little (o) notation, recurrences, probabilistic analysis, disjoint set operations, union and find algorithms.	CO1
UNIT 2	DIVIDE AND CONQUER General method, applications-analysis of binary search, quick sort, merge sort, AND OR Graphs. GREEDY METHOD: General method, Applications-job sequencing with deadlines, Fractional knapsack problem, minimum cost spanning trees, Single source shortest path problem.	CO2
UNIT 3	Pattern Matching with Regular Expressions Breadth first search and traversal, Depth first search and traversal, Spanning trees, connected components and bi-connected components, Articulation points. DYNAMIC PROGRAMMING: General method, applications - optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem, Reliability design.	CO3
UNIT 4	Files General method, Applications- n-queen problem, Sum of subsets problem, Graph coloring and Hamiltonian cycles. BRANCH AND BOUND: General method, applications - travelling sales person	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	problem, 0/1 knapsack problem- LC branch and bound solution, FIFO branch and bound solution	
UNIT 5	Web Scraping Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.

Reference Books:

R1: R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.

R2: Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.

R3: Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	-	-	-	-	-	-	1
CO2	3	3	3	3	1	-	-	-	-	-	-	2
CO3	3	3	3	3	1	-	-	-	-	-	-	2
CO4	3	3	3	3	1	-	-	-	-	-	-	2
CO5	3	3	3	3	1	-	-	-	-	-	-	2

Operating System

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Operating System
Course Code	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	<ol style="list-style-type: none"> 1. To educate students regarding basics of operating system. 2. To sensitize students about organization and process scheduling. 3. To equip students with concurrency. 4. To train students about memory management. 5. To inculcate the benefits of File systems and storage management.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Understand the basic concepts of operating system. CO2: Apply the organization and process scheduling. CO3: Analyse the process synchronization. CO4: An understanding of memory management. CO5: Develop understanding of File systems and storage management.

Course Outline

Unit	Description	CO Mapping
UNIT 1	Introduction Functions, components and structure of OS. Types of Operating Systems– Multiprogramming, Batch and Time Shared; Operating Systems for Personal Computers, Workstations, Hand-held Devices, Real time Systems, Operating System services, System Calls.	CO1
UNIT 2	Organization and Process Scheduling Processor and User Modes, Kernels, Process and Resources, Context switching, Threads, Threading Issues, Thread Libraries; Process Scheduling, Non-Pre-emptive and Pre-emptive Scheduling Algorithms, Multiprocessor scheduling. Deadlocks - Resource allocation and management, conditions for deadlock, Deadlock handling mechanisms: prevention, avoidance, detection, recovery.	CO2
UNIT 3	Process Synchronization Inter-process communication, Synchronization - Implementing synchronization primitives (Peterson’s solution, Bakery algorithm, synchronization hardware), Semaphores, Classical synchronization problems, Monitors, Classical IPC Problems: Reader’s & Writer Problem, Dining Philosopher Problem etc., Multiprocessors and Locking - Scalable Locks - Lock-free coordination.	CO3
UNIT 4	Memory Management Physical and Virtual Address Space; Main memory management, Memory Allocation Strategies, Virtual memory: Hardware support for virtual memory (caching, TLB), Paging, Segmentation,	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Demand Paging, Page Faults, Page Replacement, Thrashing - Working Set.	
UNIT 5	File Systems, storage management and security Concept of a file, Directory Structure, File Operations, File System Mounting, File Sharing, Protection, File System Structure, File System Implementation, I/O Systems- Overview of Mass Storage Structure, Device Drivers, Disk Structure, Disk Scheduling, Disk Management, and Swap space Management, Free-space Management, Directory Implementation, RAID Structure	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: Silberschatz, A., Galvin, P.B., & Gagne, G. (2008). Operating Systems Concepts (8th ed.). John Wiley Publications.

Reference Books:

R1: Tanenbaum, A. S. (2016). Modern Operating Systems (4th ed.). Pearson.

R2: Stallings, W. (2018). Operating Systems: Internals and Design Principles (9th ed.). Pearson.

R3: Milenkovic, M. (1992). Operating Systems: Concepts and Design. Tata McGraw Hill.

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	3	-	-	-	-	-	-	-	2
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Artificial Intelligence

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Artificial Intelligence
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none">1. Develop a comprehensive understanding of the fundamental concepts and applications of Artificial Intelligence.2. Gain knowledge of the major techniques and technologies used in Machine Learning and their applications in various domains.3. Develop an understanding of Natural Language Processing and its applications in fields such as chatbots, sentiment analysis, and language translation.4. Explore the applications and techniques of Computer Vision in real-world scenarios and understand the ethical considerations related to its use.5. Stay up-to-date with emerging trends and advancements in AI, and understand their implications for society and the workforce.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1: Students will be able to define Artificial Intelligence, describe its history and applications, and analyze ethical considerations related to AI.</p> <p>CO2: Students will be able to understand the basics of Machine Learning, including the different types of algorithms, data preparation, and processing. They will also be able to identify successful Machine Learning projects.</p> <p>CO3: Students will be able to identify the different techniques used in Natural Language Processing, understand the applications of NLP, and identify the ethical considerations related to NLP.</p> <p>CO4: Students will be able to identify the different techniques used in Computer Vision, understand the applications of Computer Vision, and identify the ethical considerations related to Computer Vision.</p> <p>CO5: Students will be able to identify emerging trends in Artificial Intelligence, including advanced AI technologies and techniques, AI</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	and IoT, AI and Robotics, and future directions of AI research and development. They will also be able to analyze the implications of AI for society and the workforce.
--	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT 1	Introduction to Artificial Intelligence: Definition of Artificial Intelligence, Brief history of Artificial Intelligence, Applications of Artificial Intelligence, Ethical considerations in Artificial Intelligence, Overview of AI technologies and techniques	CO1
UNIT 2	Machine Learning: Introduction to Machine Learning, Types of Machine Learning algorithms, Supervised, unsupervised and reinforcement learning, Data preparation and processing for Machine Learning, Case studies of successful Machine Learning projects	CO2
UNIT 3	Natural Language Processing (NLP): Introduction to NLP, Basic techniques of NLP, Applications of NLP, NLP libraries and tools, Ethical considerations in NLP	CO3
UNIT 4	Computer Vision: Introduction to Computer Vision, Basic techniques of Computer Vision, Applications of Computer Vision, Computer Vision libraries and tools, Ethical considerations in Computer Vision	CO4
UNIT 5	Emerging Trends in Artificial Intelligence: Advanced AI technologies and techniques, AI and Internet of Things (IoT), AI and Robotics, Future directions of AI research and development, Implications of AI for society and the workforce	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: Russell, S. J., & Norvig, P. (2020). Artificial intelligence: A modern approach. Pearson

Reference Books:

R1: Bishop, C. M. (2006). Pattern recognition and machine learning. Springer.

R2: Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.

R3: Shane, M. (2018). Artificial intelligence and ethics. Morgan & Claypool Publishers.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO MAPPING

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

Programming Paradigm Using Python Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Programming Paradigm Using Python Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	ES
Course Objective	<p>This course enables the students</p> <ol style="list-style-type: none"> 1. To be able to introduce core programming basics and program design with functions using Python programming language. 2. To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques. 3. To understand the high-performance programs designed to strengthen the practical expertise.
Course Outcome (COs)	<p>Upon the completion, the student will be able to:</p> <p>CO1: Student should be able to understand the basic concepts scripting and the contributions of scripting language</p> <p>CO2: Ability to explore python especially the object oriented concepts, and the built in objects of Python.</p> <p>CO3: Implement methods to create and manipulate lists, tuples and dictionaries.</p> <p>CO4: Apply the concepts of file handling and regEx using packages.</p> <p>CO5: Illustrate the working of scraping websites with CSV</p>

Course Outline

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Unit	Description
Lab 1	Programs on Introduction to Python and Computer ProgramminG
Lab 2	Data Types, Variables, Basic Input-Output Operations, Basic Operators
Lab 3	Boolean Values, Conditional Execution, Loops.
Lab 4	Lists and List Processing, Logical and Bitwise Operations
Lab 5	Functions, Tuples
Lab 6	Dictionaries, and Data Processing
Lab 7	Modules, Packages, String and List Methods, and Exceptions
Lab 8	The Object-Oriented Approach: Classes, Methods, Objects, and the Standard Objective Features;
Lab 9	Exception Handling, and Working with Files
Lab 10	Programs on web scraping
Lab 11	Programs on sheet update

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

T1: Al Sweigart, "Automate the Boring Stuff with Python", William Pollock, 2015, ISBN: 978-1593275990

Reference Books:

R1: Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015, ISBN: 978-9352134755.

R2: Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.

R3: Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

R4: Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

R5: Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	2	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	2	1	-	2	-	-	-	-	-	-	1
CO4	3	3	3	2	1	-	-	-	-	-	-	2
CO5	1	2	3	1	0	-	-	-	-	-	-	1

Design and Analysis of Algorithms Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Design and Analysis of Algorithms Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	ES
Course Objective	<p>This course enables the students</p> <ol style="list-style-type: none">1. The principle objective of this course is to build solid foundation in algorithms and their applications. To implement various divide and conquer techniques examples.2. To implement various Greedy techniques examples.3. To implement various Dynamic Programming techniques examples.4. To provide a practical exposure of all algorithms.5. To understand the importance of algorithm and its complexities.
Course Outcome (COs)	<p>At the end of the Course the student shall be able to</p> <p>CO1: Develop programs for sorting a given set of elements and analyse its time complexity.</p> <p>CO2: Solve and analyse the problems using greedy methods.</p> <p>CO3: Solve and analyse the problems using dynamic programming.</p> <p>CO4: Apply backtracking method to solve various problems.</p> <p>CO5: Apply branch and bound method to solve 0/1 knapsack problem.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description
Lab 1	Implementation of search algorithms
Lab 2	Analysis of time and space complexities
Lab 3	Programs on Sorting Algorithms: Selection sort, Insertion sort, Heap sort
Lab 4	Programs on Sorting Algorithms: Merge sort, Quick sort;
Lab 5	Programs on Binary Search Tree and Tree traversals.
Lab 6	Shortest path algorithms: Kruskal, Prim's, Dijkstra,
Lab 7	Implementation of Floyd –Warshall, Bellman-Ford;
Lab 8	Programs on Graph Traversal: DFS, BFS; Back Tracking,
Lab 9	Exception Handling, and Working with Files
Lab 10	Programs on Dynamic Programming. Height Balanced Tree.
Lab 11	Programs on P-NP, NP complete problem

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

T1: Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.

Reference Books:

R1: R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.

R2: Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

R3: Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	1
CO2	3	3	3	3	3	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1

UNIX and Shell Programming Laboratory

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	IV
Course Title	Unix and Shell Programming Laboratory
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	ES
Course Objective	To teach students various Unix utilities and shell scripting.
Course Outcome (COs)	At the end of the Course the student shall be able to CO1: Understand the basic UNIX process structure and the UNIX file system. CO2: Understand the roles of unix developers / systems programmers CO3: Good knowledge of simple UNIX filters. And Familiar with pipes and redirection, imagine the UNIX environment. CO4: Practice various commands related to Signals, filter parameters and options, CO5: Differentiate shell scripting and commands practice with various options.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description
Lab 1	Use of basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
Lab 2	Study of vi editor
Lab 3	Commands related to inode, I/O redirection, piping, process control commands, mails.
Lab 4	Shell Programming: shell script exercise based on following: a) Interactive shell script b) Positional parameters c) Arithmetic d) If-then-fi, if-then-else-fi, nested if-else e) Logical operators f) Else + if equals elif, case structure g) While, for loop h) Meta characters
Lab 5	Write a shell script to create a file in \$USER /class/batch directory. Follow the Instructions a) Input a page profile to yourself, copy it into other existing file b) Start printing file at certain line c) Print all the difference between two file, copy the two files at \$USER/CSC/2007 directory. d) Print lines matching certain word pattern.
Lab 6	Write shell script for- 1. Showing the count of users logged in 2. Printing Column list of files in your home directory. 3. Listing your job with below normal priority 4. Continue running your job after logging out.
Lab 7	Write a shell script to change date format. Show the time taken in execution of this script.
Lab 8	Write a shell script to print file names in directory showing date of creation & serial no. of file.
Lab 9	Write a shell script to count lines, words & characters in its input. (Do not use wc).

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Lab 10	Write a shell script to print end of a Glossary file in reverse order using array.
Lab 11	Write a shell script to check whether Ram logged in, continue checking further after every 30 seconds till success.

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Books:

1. **UNIX and Shell Programming: A Text Book** by **B. M. Harwani** (Oxford University Press)
2. **UNIX Shell Programming** by **Yashavant Kanetkar** (BPB Publications)

Reference Books:

1. **Unix Concepts and Applications** by **Sumitabha Das** (Tata McGraw Hill Education)

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	3	-	-	-	-	-	-	1
CO2	2	3	3	2	3	-	-	-	-	-	-	2
CO3	3	2	1	1	2	-	-	-	-	-	-	1
CO4	1	3	2	2	3	-	-	-	-	-	-	2
CO5	2	1	1	1	2	-	-	-	-	-	-	1

V Semester

Theory Subjects

Engineering Economics and Costing

School	Birla School of Engineering and Technology
Programme	BTECH
Batch	2023-24
Branch/Discipline	BTECH
Semester	5
Course Title	Engineering Economics and Costing
Course Code	
Credit	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Type	Core Course
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. To introduce the concept of time value of money and its role in engineering decision-making. 2. To equip students with methods for evaluating and comparing investment alternatives. 3. To familiarize students with depreciation, taxation, and break-even concepts in cost analysis. 4. To develop skills for analyzing risk and uncertainty using sensitivity analysis. 5. To provide an understanding of costing methods, cost estimation, and techniques for cost control and reduction.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Apply the concepts of time value of money to engineering and financial decisions.</p> <p>CO2. Evaluate investment alternatives using present worth, future worth, payback period, and annual worth methods.</p> <p>CO3. Analyze projects using rate of return methods, and conduct benefit-cost analysis for public projects.</p> <p>CO4. Compute depreciation, perform after-tax comparisons, and apply break-even and sensitivity analysis in decision-making.</p> <p>CO5. Estimate and analyze costs, and apply cost control and reduction techniques in engineering and business contexts.</p>

Course Outline

Unit	Description	CO Mapping
UNIT1	Time Value of Money and Cash Flow Analysis This Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time value equivalences.	CO1
UNIT2	Investment Decision Methods – Present and Future Worth Present worth comparisons, Comparisons of assets with equal, unequal and infite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.	CO2
UNIT3	Equivalent Annual Worth & Rate of Return Analysis Comparison of assets of equal and unequal life. Rate of return, Internal rate of return, comparison of IIR with other methods, IRR misconceptions. Analysis of public Projects: Benefit/ Cost analysis,	CO3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis.	
UNIT4	Depreciation, Taxation & Break-even Analysis Depreciation, Computing depreciation charges, after tax economic comparison, Break-even analysis; linear and non-linear models. Sensitivity analysis: single and multiple parameter sensitivity	CO4
UNIT5	Costing, Estimation & Cost Control Fixed and variable cost, Product and Process Costing, Standard Costing, Cost estimation, Relevant Cost for decision making, Cost estimation, Cost control and Cost reduction techniques	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Horn green, C.T., Cost Accounting, Prentice Hall of India
2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996 (Chapter 2,3,4,5,7,8,9,11,12)

CO-PO mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	2	–	–	–	3	2	1
CO2	3	3	–	–	–	2	–	–	–	3	2	1
CO3	3	3	2	2	–	2	–	–	–	3	2	2
CO4	3	3	2	2	–	2	–	–	–	3	2	2
CO5	3	3	2	2	–	2	2	–	–	3	2	2

CSET-5002: Automata Theory and Compiler Design

School	Birla School of Engineering and Technology
Programme	BTECH
Batch	2023-24
Branch/Discipline	BTECH
Semester	5
Course Title	Automata Theory and Compiler Design
Course Code	CSET-5002
Credit	2
Course Type	Core Course

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	The subject aims to provide the student with: <ol style="list-style-type: none"> 1. To provide an understanding of automata, grammars, language translators. 2. To know the various techniques used in compiler construction. 3. To be aware of the process of semantic analysis. 4. To analyze the code optimization & code generation techniques.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Understand the necessity and types of different language translators in use. CO2: Apply the techniques and design different components (phases) of a compiler. CO3: Ability to implement practical aspects of automata theory. CO4: Use the tools Lex, Yacc in compiler construction

Unit	Description	CO Mapping
UNIT1	Formal Language and Regular Expressions Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Context Free grammars and parsing, derivation, parse trees, Application of Finite Automata.	CO1
UNIT2	Introduction To Compiler Phases of Compilation, ambiguity LL(K) grammars and LL(1), parsing Bottom up parsing handle pruning LR Grammar Parsing, LALRparsing, parsing, ambiguous grammars, YACC programming specification. Semantics: Syntax directed translation, S-attributed and L-attributed grammars,	CO2
UNIT3	Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers, type checking, type conversions, equivalence of type expressions, overloading of functions and operations.	CO3
UNIT4	Run time storage: Storage organization, storage allocation strategies scope access to nonlocal names, Code optimization: Principal sources of optimization, optimization of basicblocks, peephole optimization,	CO4
UNIT5	Code generation: Machine dependent code generation, object code forms, generic code generation algorithm, Register allocation and assignment. Using DAG representation of Block.	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Introduction to Theory of computation. Sipser, 2nd Edition, Thomson.
2. Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

REFERENCE Books:

1. Modern Compiler Construction in C , Andrew W.Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.
6. Introduction to Formal Languages and Automata Theory and Computation - Kamala Krithivasan and Rama R, Pearson.
7. Modern Compiler Design, D. Grune and others, Wiley-India.
8. A Text book on Automata Theory, S. F. B. Nasir, P. K. Srimani, Cambridge Univ.Press.
9. Automata and Language, A. Meduna, Springer

CO-PO mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	–	2	–	–	–	3	2	1
CO2	3	3	–	–	–	2	–	–	–	3	2	1
CO3	3	3	2	2	–	2	–	–	–	3	2	2
CO4	3	3	2	2	–	2	–	–	–	3	2	2
CO5	3	3	2	2	–	2	2	–	–	3	2	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Data Mining & Data Warehousing

School	Birla School of Engineering & Technology
Programme	B.Tech
Batch	2025-26
Branch/Discipline	B.Tech
Semester	V
Course Title	Data Mining & Data Warehousing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit -3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Data Mining and Data Warehousing. 2. An introduction to Data Warehousing Modeling. 3. An understanding of Association Rule Mining and its applications. 4. An understanding of Classification and Prediction. 5. An introduction to applications of Data Mining.
Course Outcome (COs)	After completion of this course students will be able to: CO1: Explain the needs of Data Warehousing and Data Mining. CO2: Explain the working of Data Warehousing Modeling and its procedures. CO3: Demonstrate the use of Association Rule Mining with its use cases. CO4: Explain the working of Classification and Prediction Modeling. CO5: A better understanding of data mining's applications.

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction: The knowledge discovery process, Data Mining: Steps in Data mining, Data Mining Functionalities, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems. Data Pre-processing: Data Cleaning Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.	CO1
UNIT2	Data Warehouse Modelling: Data Cube and Online Analytical Processing (OLAP), Data Warehouse Schemas: Data Cube A Multidimensional Data Model, Stars,	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Snowflakes, and Fact Constellations Schemas, Major Data Mining Techniques, Data warehouses and Data marts, OLAP operations: Drill-down and roll-up, slice and dice or rotation. MOLAP vs ROLAP models, Data Warehousing and Business Analysis: Data warehousing Components, Data Warehouse Architecture, ETL: Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications. OLAP and Multidimensional Data Analysis.	
UNIT3	Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods Mining Various Kinds of Association Rules Association Mining to Correlation Analysis Constraint Based Association Mining. Types of Data, Proximity measures, Major Clustering Methods: Partitioning Methods Hierarchical methods: Agglomerative versus Divisive Hierarchical Clustering, BIRCH, DBSCAN clustering. Measuring Clustering Quality, Cluster Analysis.	CO3
UNIT4	Classification and Prediction: Rule Based Classification, Classification by Decision Tree, Introduction Bayesian Classification, Classification by ANN using Back propagation, Support Vector Machines, Lazy Learners, Prediction Accuracy and Error Measures, Ensemble Methods.	CO4
UNIT5	Applications of Data mining: Financial Data Analysis, Retail and Telecommunication Industries, Intrusion Detection, Recommender Systems. Web Mining: Page Rank Algorithm, HITS Algorithm, Text Mining: Classification based on Sentiment Phrases, Opinion Mining	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Reference Books:

1. Berson, A., & Smith, S. J. (2007). Data Warehousing, Data Mining & OLAP (Tenth Reprint). Tata McGraw-Hill Edition. **CO-PO Mapping**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	1	–	2	2
CO2	3	3	2	2	3	1	–	–	1	–	2	2
CO3	3	3	3	2	3	1	–	1	1	–	2	2
CO4	3	3	2	3	3	1	–	1	2	–	2	2
CO5	3	3	3	3	3	2	1	1	2	2	2	3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Software Engineering

School	Birla School of Engineering & Technology
Programme	B.Tech
Batch	2025-26
Branch/Discipline	B.Tech
Semester	
Course Title	Software Engineering
Course Code	
Credit	L-T-P- 3-0-0 Total Credit -3
Course Type	Core Course
Course Objective	The subject aims to provide the student with: 1. An understanding of basic concepts of Software Engineering. 2. An introduction to the fundamentals of Requirement Engineering. 3. An understanding of Object-oriented design and UML. 4. An introduction to Architectural Design. 5. An introduction to Project Management.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Explain the needs of Software Engineering. CO2. Explain the working and importance of Requirement Engineering. CO3. Demonstrate the use of object-oriented design and UML. CO4. Explain the flow of Architectural Design. CO5. Explain the need of Project Management.

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction: Introduction to Software Development processes, Agile software development: Agile methods, Plan-driven and agile development, Extreme programming, Agile Process model: Adoptive software development, scrum, crystal, Agile modelling, Agile unified process.	CO1
UNIT2	Requirements engineering: Functional and non-functional requirements: The software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT3	<p>Function oriented Software Design: SA/SD Methodology, Data Flow Diagrams, Structured Design Transformation of DFD into Structure chart, Transformation and Transaction Analysis</p> <p>Object-oriented design using UML: Analysis and Design: Concepts, Classes and Objects. Relationships Among Objects. Inheritance and Polymorphism, Design Concepts, Design Notation and Specification, Design Methodology, Dynamic Modelling, Functional Modelling, Defining Internal Classes and Operations, Design patterns.</p>	CO3
UNIT4	<p>System modelling: Context models, Interaction models, Structural models, Behavioural models Model-driven engineering.</p> <p>Architectural Design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures, Design and implementation,</p> <p>Testing: Introduction to software testing, verification and validation, unit testing, integration testing, system testing. Software Maintenance.</p>	CO4
UNIT5	<p>Project Management: Introduction to Risk management, managing people, Teamwork, Project planning, Software pricing, Plan-driven development, Project scheduling, Estimation techniques, Quality management, Software measurement and metrics.</p> <p>Introduction to Advanced Software Engineering concepts: Software reuse, Component-based software engineering, Distributed software engineering, Service-oriented architecture, Embedded software, Aspect-oriented software engineering</p>	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Rajib Mall, (2018) Fundamentals of Software Engineering-, PHI, New Delhi. 5th Edition,
2. Roger S. Pressman, Bruce R. Maxim, (2019) Software Engineering-A practitioner's approach-McGraw-Hill International Editions, New York. ISBN: 9789353165710, 9353165717, Edition: 8,

Reference Books:

1. Ugrasen Suman, (2013) Software Engineering: Concepts & Practices, Cengage Learning publications. 1st Edition,
2. Aggarwal, K. K. & Singh, Y: Software Engineering (New Age International)
3. **CO-PO Mapping**

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	1	–	2	2
CO2	3	3	3	2	2	1	–	1	1	–	2	2
CO3	3	3	3	2	3	1	–	1	2	–	2	2
CO4	3	3	2	3	3	1	–	1	2	–	2	2
CO5	3	3	3	2	2	2	1	2	2	3	2	3

Cyber Security

School	Birla School of Engineering & Technology
Programme	B>Tech
Batch	2025-26
Branch/Discipline	
Semester	
Course Title	Cyber Security
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	CC
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. Understand the importance of cybersecurity and the impact of cyber-attacks on organizations and individuals. 2. Recognize different types of cyber threats and attacks, such as malware, viruses, and ransomware, and understand how to mitigate them. 3. Identify and evaluate various cybersecurity technologies and tools, including intrusion detection and prevention systems, security information and event management, endpoint protection tools, and vulnerability assessment and penetration testing. 4. Develop information security policies and procedures, incident response planning and management, security awareness and training, and physical security considerations to ensure the security of organizational assets. 5. Stay up-to-date with emerging cybersecurity threats and trends, advances in cybersecurity technologies, and ethical considerations in cybersecurity to ensure preparedness for the future.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Understand the definition of Cybersecurity and the importance of protecting digital assets.</p> <p>CO2. Recognize various types of Cybersecurity threats and attacks, and apply risk management principles to assess and mitigate potential vulnerabilities.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<p>CO3. Explain basic Cryptography and encryption concepts, network security, firewalls, and identify security tools used in Cybersecurity.</p> <p>CO4. Develop Information Security policies and procedures, incident response planning, and management, and evaluate compliance with regulatory requirements.</p> <p>CO5. Analyze emerging Cybersecurity threats and trends, evaluate the latest Cybersecurity technologies, and understand ethical considerations in Cybersecurity.</p>
--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to Cybersecurity: Definition of Cybersecurity ,Importance of Cybersecurity, Cybersecurity threats and attacks, Overview of Cybersecurity frameworks and standards ,Basic principles of Cybersecurity	CO1
UNIT2	Network Security: Fundamentals of network security, Types of network security threats, Network security protocols and technologies, Network security best practices	CO2
UNIT3	Cybersecurity Technologies and Tools: Intrusion detection and prevention systems (IDS/IPS), Security Information and Event Management (SIEM), Endpoint protection tools ,Vulnerability assessment and penetration testing, Security Operations Center (SOC) tools	CO3
UNIT4	Cybersecurity Policies and Procedures: Information security policies and procedures, Incident response planning and management, Security awareness and training, Physical security considerations, Compliance and regulatory requirements	CO4
UNIT5	Future of Cybersecurity: Emerging Cybersecurity threats and trends, Advances in Cybersecurity technologies, Ethical considerations in Cybersecurity	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Suggested Books:

1. Ciampa, M. (2021). Security+ guide to network security fundamentals. Cengage Learning.

Reference Books:

1. Pfleeger, C. P., & Pfleeger, S. L. (2018). Security in computing. Pearson

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	–	–	–	2	2
CO2	3	3	2	2	3	2	2	–	–	–	2	2
CO3	3	3	2	3	3	2	2	–	1	–	2	2
CO4	3	3	2	3	3	2	2	1	1	–	2	2
CO5	3	3	2	2	2	3	3	1	1	–	2	3

Constitution of India

School	Birla School of Engineering & Technology
Programme	B.Tech
Batch	2025-26
Branch/Discipline	
Semester	
Course Title	Constitution of India
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. To create an awareness on the Constitution of India. 2. To understand the function wings of the Government, fundamental rights and duties of citizen 3. Analyse the powers of central, state, and local government, and strengthen constitutional institutions.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO 1: Describe historical background of the constitution making and its importance for building a democratic India.</p> <p>CO 2: Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.</p> <p>CO 3: Explain the value of the fundamental rights and duties for becoming good citizen of India.</p> <p>CO 4: Analyse the decentralisation of power between central, state and local self-government.</p> <p>CO 5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy..</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to Indian Constitution (10 Lectures) Constitution meaning of the term - The making of the Indian Constitution - Sources and constitutional history – Philosophy of Constituent Assembly - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.	CO1
UNIT2	The Union: Executive, Legislative and Judiciary Union Government and its Administration Structure: President and Vice President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions.	CO2
UNIT3	The States and The Union Territories State Government and its Administration: Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions – Relation between the Union and the States	CO3
UNIT4	Local Administration District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative – Panchayati Raj: Functions PRI: Zilla Panchayat, Elected officials and their roles - Block level Organizational Hierarchy, Village level - Role of Elected and Appointed officials - Importance of grass-root democracy	CO4
UNIT5	Emergency Provisions and Election Commission Emergency: Proclamation of Emergency, types of emergency - Election Commission: Role of Chief Election Commissioner - State Election Commission - Functions of Commissions for the welfare of SC/ST/OBC and women.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th Edition, Universal Law Publication.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

References

1. J.C. Johari, Indian Government and Politics Hans

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	–	–	–	3	3	–	–	–	2	3
CO2	2	2	–	–	–	3	3	–	1	–	2	3
CO3	2	2	–	–	–	3	3	–	1	–	2	3
CO4	2	2	1	–	–	3	3	1	1	–	2	3
CO5	2	2	–	–	–	3	3	1	1	–	2	3

Practical Subjects

Data Mining & Data Warehousing Lab

School	Birla School of Engineering & Technology
Programme	B.Tech
Batch	2025-26
Branch/Discipline	B.Tech
Semester	
Course Title	Data Mining & Data warehousing
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	
Course Objective	<ol style="list-style-type: none">1. Develop Python proficiency for data mining:2. Apply data mining techniques3. Evaluate and interpret mining results:4. Develop critical thinking and problem-solving skills.5. Collaborate effectively in a team
Course Outcome (COs)	<p>CO1. Develop proficiency in Python for data mining: Students will gain a strong foundation in Python and</p> <p>CO2. Apply data mining techniques to real-world problems: Students will learn how to identify and apply appropriate data mining techniques</p> <p>CO3. Evaluate and interpret mining results: Students will develop the ability to evaluate and interpret the results of data mining algorithms.</p> <p>CO4. Develop critical thinking and problem-solving skills: Through the process of designing and implementing data mining solutions</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	CO5. Collaborate effectively in a team: Students will have opportunities to work collaboratively in small groups on data mining projects
--	------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Lab	Description	CO Mapping
Lab :1	Introduction to Python <ul style="list-style-type: none"> • Introduction to Python and its data mining libraries (e.g., NumPy, Pandas, Scikit-learn) 	CO1
Lab :2	<ul style="list-style-type: none"> • Matrix Operations 	CO1
Lab :3	<ul style="list-style-type: none"> • Linear Algebra on Matrices 	CO2
Lab :4	<ul style="list-style-type: none"> • Understanding Data 	CO2
Lab :5	<ul style="list-style-type: none"> • Correlation Matrix 	CO2
Lab :6	<ul style="list-style-type: none"> • Data Cleaning and Outlier Detection and handling missing values 	CO3
Lab :7	Data Transformation and Normalization <ul style="list-style-type: none"> • Data transformation techniques (e.g., data type conversion, data reduction) • Techniques for data normalization (e.g., min-max normalization, z-score normalization) • Implementation of data transformation and normalization using Python 	CO3
Lab :8	Mining Frequent Patterns and Associations <ul style="list-style-type: none"> • Frequent pattern mining and association rule mining • Mining frequent patterns and associations using Python • Evaluation and interpretation of mined patterns and associations 	CO4
Lab :9	Correlation Analysis and Constraint-Based Mining <ul style="list-style-type: none"> • Correlation analysis and constraint-based mining • Techniques for mining correlation rules and constrained patterns • Implementation of correlation analysis and constraint-based mining using Python 	CO4
Lab :10	Classification and Prediction <ul style="list-style-type: none"> • Classification and prediction techniques • Techniques for feature selection and model evaluation • Implementation of classification and prediction using Python 	CO5
Lab :11 -12	Cluster Analysis <ul style="list-style-type: none"> • Cluster analysis and its applications 	CO5

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<ul style="list-style-type: none"> • Techniques for clustering data (e.g., K-means, hierarchical clustering, density-based clustering) • Implementation of cluster analysis using Python 	
--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Text Book:

1. Han, J., Kamber, M., & Pei, J. (2012). Data mining: concepts and techniques (3rd ed.). Morgan Kaufmann Publishers.

Reference books:

1. Marsland, S. (2015). Machine learning: an algorithmic perspective (2nd ed.).

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	1	–	–	–	–	2	2
CO2	3	3	3	2	3	1	–	1	–	–	2	2
CO3	3	3	2	2	3	1	–	1	1	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	3	2	2	2	3

Software Engineering Lab

School	Birla School of Engineering & Technology
Programme	B.Tech
Batch	2025-29
Branch/Discipline	B.Tech
Semester	V
Course Title	Software Engineering lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	The subject aims to provide the student with: <ol style="list-style-type: none"> 1. To develop an SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams, etc., for a given software project. 2. To develop efficient codes for some given software projects and test the developed code using different tools. 3. To implement different software project management techniques. 4. To use different computer-aided software engineering (CASE)tools.
Course Outcome (COs)	After completion of this course students will be able to: <p>CO1: Develop SRS document, design documents such as ER Diagrams, DFDs, UML Diagrams etc. for a given software project.</p> <p>CO2: Develop efficient codes for a given software project using appropriate coding standards and guidelines and test the developed code using different tools.</p> <p>CO3: Implement different software project management techniques such as FP, COCOMO, CPM, PERT etc.</p> <p>CO4: Know the use of different computer aided software engineering (CASE) tools in the development, maintenance and reuse of software systems.</p>

Course Outline

Unit	Description	CO Mapping
Expt 1	Prepare the SRS document for a given problem, such as the below mentioned problems. You should identify the appropriate requirements for the given problem; Draw the E-R Diagram using any available tool, Draw the DFD for the given problem using any available tool, Draw the Use Case diagram, Domain Models, and Class Diagram, Sequence Diagrams and Collaboration Diagrams for each Use Case, State Chart Diagram and Activity Diagram, (if necessary) using any available tool; Develop the corresponding software using any programming language such as Java, Python, etc. with an interactive GUI and appropriate Database.a) Develop software to automate the bookkeeping activities of a 5star hotelb) The local newspaper and magazine delivery agency wants toautomate the various clerical activities associated with itsbusiness. Develop a software for this.c) A small automobile spare parts shop sells the spare parts forvehicles of several makes and models. Each spare part istypically manufactured by several small industries. Tostreamline the sales and supply ordering, the shop owner wantsto automate the activities associated with his business. Developa software for this.d) Develop a software for the automation of the dispensary of yourcollege.e) Develop a software for automating various activities of theEstate Office of your college.f) Develop a word processing software with some	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	limited number of facilities such as making bold italics, underline, cut, copy and paste etc.g) Develop a graphics editor software package, using which one can create / modify several common types of graphics entities.h) Develop a software for automating various activities of the departmental offices of your college.	
Expt 2	a) Estimate the size of a given software using Function Point Metric. b) Write a C function for searching an integer value from a large sorted sequence of integer values stored in array of size 100, using the binary search method. Build the control flow graph (CFG) of this function using any compiler writing tool. Write a program in Java to determine its cyclomatic complexity. Identify the linearly independent paths and generate the test cases using path coverage based strategy.	CO2
Expt 3	a) To perform various testing operations using the available testing tools for a given system. b) Write a program in Java to determine the number of defects still remaining after testing, using error seeding methodology.	CO3
Expt 4	a) Draw the GANT chart for a given software project using any available tool such as GanttProject.	CO4
Expt 5	a) Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for a given problem using CPM. You may use any available tool for this such as GanttProject, ProjectLibre etc. b) Draw the network diagram, find out the critical path and critical activities, and calculate the project duration for a given problem using PERT. You may use any available tool for this such as GanttProject, ProjectLibre etc.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Suggested Books:

1. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.
2. Sommerville, I. (2017). Software Engineering (10th ed.). Pearson Education.

Reference Books:

1. Suman, U. (2013). Software Engineering: Concepts & Practices (1st ed.). Cengage Learning publications.
2. Aggarwal, K. K., & Singh, Y. (Year). Software Engineering. New Age International.
3. Pressman, R. S., & Maxim, B. R. (2019). Software Engineering: A Practitioner's Approach (8th ed.). McGrawHill International Editions.
4. Jalote, P. (2019). An Integrated Approach to Software Engineering (3rd ed.). Narosa Publishing House.
5. Mall, R. (2018). Fundamentals of Software Engineering (5th ed.). PHI.
6. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw-Hill Education (India), New Delhi.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	–	–	1	1	–	2	2
CO2	3	3	3	2	3	1	–	2	1	–	2	2
CO3	3	3	2	3	3	–	–	1	1	–	2	2
CO4	2	2	2	2	2	–	–	1	3	1	2	2
CO5	3	3	3	2	3	2	1	3	2	2	2	3

VI Semester

Theory Subjects

Optimization Techniques

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	VI
Course Title	Optimization Techniques
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	<ol style="list-style-type: none"> 1. To make students understand the basics of optimization. 2. An introduction to single variable optimization. 3. An introduction to multivariable optimization. 4. An induction to constrained optimization algorithm. 5. An understanding of modern optimization algorithm.
Course Outcome (COs)	After completion of this course students will be able to: CO1. Students understand the basic concept of optimizations problems and techniques CO2. Explore various single variable optimization. CO3. Sound knowledge of multivariable optimization. CO4. Skills to understand constrained optimization algorithms. CO5. Perform modern optimization algorithms.

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction and Basic Concepts: Introduction to optimization problem, optimization problem formulation, examples of optimization problems, Local and global optimization, optimization algorithms	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT2	Single Variable Optimization: Optimality criteria, exhaustive search methods, bounding phase method, region-elimination methods-Fibonacci search method, golden section search method. Successive quadratic estimation Method, Gradient based methods-Newton-Raphson method, Bisection method, Sacant method	CO2
UNIT3	Multivariable Optimization: Optimality criteria, unidirectional search, direct search methods evolutionary search method, simplex search method, HookJeeves pattern search method, Gradient-based methods: Cauchy's steepest descent method, Newton's method, Marquardt's method,	CO3
UNIT4	Constrained Optimization Algorithms: Kuhn-Tucker conditions, transformation methods, sensitivity, direct search for constrained optimization, integer programming, Geometric programming.	CO4
UNIT5	Modern Optimization Techniques: Genetic algorithms, simulated annealing, swarm optimization, ant colony optimization	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books

1. Deb, K. (Year). Optimization for Engineering Design: Algorithms and Examples. PHI.
2. Rao, S. S. (2019). Engineering Optimization: Theory and Practice (5th ed.). Wiley

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	1	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

Machine Learning

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	VI

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Title	Machine Learning
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	<ol style="list-style-type: none"> 1. An understanding of basic concepts of Machine Learning. 2. An introduction to the fundamentals of Supervised Learning. 3. An understanding of Support Vector Machine. 4. An introduction to Evaluation. 5. An introduction to Unsupervised Learning. 6. An introduction to Deep Networks.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Explain Machine Learning as well as its needs. CO2. Explain Supervised Learning and its usage. CO3. Demonstrate the use of Support Vector Machine CO4. Understanding the concept of Deep Neural Networks and Convolution Neural Network CO5. Understanding the concept and implementation of Genetic Algorithms</p>

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Introduction Introduction: Learning theory, Hypothesis and target class, Inductive bias and bias-variance tradeoff, Occam's razor, Approximation and estimation errors. Dimensionality reduction and Feature selection, PCA, Model Evaluation: Performance evaluation metrics, ROC Curves, Validation methods</p>	CO1
UNIT 2	<p>Supervised Learning: Linear separability and decision regions, Linear discriminants, Bayesian Theory, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, k-nearest Neighbour Algorithm Artificial Neural Networks: Introduction Mc-Culloch Pitts Neuron/ Perceptron Model, Multilayer Perception, Important Terminologies of ANNs, Back Propagation.</p>	CO2
UNIT 3	<p>Support Vector Machines: Structural and empirical risk, Margin of a classifier, Support Vector Machines, learning nonlinear hypothesis using kernel functions. Decision Tree: Decision Tree Induction, Overfitting, Pruning of decision trees Ensemble approach: Bagging and Boosting.</p>	CO3
UNIT 4	<p>Introduction to Deep Networks: Introduction to deep feed forward networks, convolutional neural networks, different terminologies related to CNN: stride, pooling, dropout, optimization techniques.</p>	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT 5	Genetic Algorithms: Genetic Algorithms: Motivation, Genetic Algorithms: Representing Hypotheses, Genetic Operator, Fitness Function and Selection, An Illustrative Example, Hypothesis Space Search, Genetic Programming. Introduction to different optimization algorithms.	CO5
---------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

T1: E. Alpaydin, (2006) Introduction to Machine Learning, Prentice Hall of India.

T2: T Hastie, R Tibshirani and J Friedman, (2009) The Elements of Statistical Learning Data Mining, Inference, and Prediction, 2nd Edition, Springer.

Reference Books:

R1: C. M. Bishop, (2010) Pattern Recognition and Machine Learning, Springer.

R2: R. O. Duda, P. E. Hart, and D.G. Stork, (2012) Pattern Classification, John Wiley and Sons. R3: Milenkovic, M. (1992). Operating Systems: Concepts and Design. Tata McGraw Hill.

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	1	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

Microprocessors and Microcontroller

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	VI
Course Title	Microprocessors and Microcontroller

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. To understand the basics of microprocessors and microcontroller architectures and their functionalities. 2. To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques. 3. To design and develop Microprocessor/ microcontroller-based systems for real-time applications using low-level languages like ALP. 4. To create an exposure to basic peripherals, its programming and interfacing techniques. 5. To understand the concepts of ARM processor.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Learn the internal organization of popular 8085-86/8051 microprocessors/microcontrollers.</p> <p>CO2. Learn hardware and software interaction and integration.</p> <p>CO3. Explain the assembly-level language programming</p> <p>CO4. Explain the Memory and Interfacing of different external peripheral devices with microprocessors and microcontrollers.</p> <p>CO5. Demonstrate the development of an assembly language program for specified application.</p>

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to Microprocessors, 8085 Architecture, and Programming: Architecture of 8085, Functional block diagram, pin configuration, bus organization (address, data, control), flags and registers, Instruction set, addressing modes of 8085, Programming basics: data transfer, arithmetic, logic, branching, looping, stack, subroutines, and simple assembly language programs for 8085, Timing diagrams, interrupts in 8085, memory and I/O interfacing basics.	CO1
UNIT2	8085 Interfacing and Peripheral Devices: Memory interfacing, I/O interfacing (peripheral/ memory-mapped), logic devices for interfacing; Detailed study and interfacing of peripheral chips:	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	8255 PPI, 8251 USART; ADC and DAC interfacing with 8085; Interrupt handling and direct memory access (DMA).	
UNIT3	16-bit Microprocessors – 8086 Architecture and Programming: 8086 microprocessor: block diagram, pin details, physical and logical address, memory segmentation. Addressing modes and instruction set of 8086, 8086 architecture vs. 8085 (comparison), Assembly language programming for 8086: arithmetic, logical, loop, and string instructions.	CO3
UNIT4	Programmable Interface Devices and Applications: Interface chips for microprocessors: 8155, 8253/8254 (timers), 8259 (interrupt controller), 8257 (DMA controller), Key concepts: interfacing keyboards, displays (including 7-segment LEDs and LCDs), and memory, Bus timing and interface techniques for peripheral devices, Serial and parallel communication principles and standards.	CO4
UNIT5	8051 Microcontroller, ARM Introduction, and Embedded Applications: Introduction to microcontrollers vs. microprocessors, 8051 architecture: block diagram, PSW, flag bits, register banks and stack, memory organization, I/O ports, 8051 instruction set, assembly language programming (I/O port, timer, serial and interrupt programming), 8051 interfacing: external ROM/RAM, ADC, sensor, keyboard, stepper/DC motor, Introduction to ARM processors: basic architecture and applications in embedded systems, Trends in microcontroller-based embedded system design.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Suggested Books:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012

Reference Books:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

5.Ramesh S. Goankar, “Microprocessor Architecture, Programming and Applications with 8085”, 5 th Edition, Prentice Hall

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	–	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

Cloud Computing

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	VI
Course Title	Cloud Computing
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. An understanding of basic concepts of cloud computing. 2. An introduction to the architecture of cloud computing. 3. A look through case studies. 4. A introduction on service management in cloud computing. 5. Knowledge on security.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Explain the needs of cloud computing.</p> <p>CO2. Explain the architecture of cloud computing.</p> <p>CO3. Explain the working of service management in cloud computing.</p> <p>CO4. Explain the security paradigms in cloud computing.</p> <p>CO5. Demonstrate the case studies which showcased the usage of cloud computing.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description	CO Mapping
UNIT1	Overview of Computing Paradigm: (8 hrs) Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Introduction to Cloud Computing, Cloud components - Essential characteristics – On-demand selfservice, Broad network access, Location independent resource pooling Benefits and limitations of Cloud Computing.	CO1
UNIT2	Cloud Computing Architecture: (8hrs) Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models-Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), How Cloud Computing Works, Deployment, Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.	CO2
UNIT3	Service Management in Cloud Computing & Virtualization (10 hrs) Service Level Agreements (SLAs),Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of Scaling. Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation	CO3
UNIT4	Cloud Security: (8 hrs) Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage-Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in Cloud Computing. Case Studies: Case Study of Service, Model using Google App Engine Microsoft Azure, Amazon EC2..	CO4
UNIT5	Cloud Simulators- (10 hrs) CloudSim and GreenCloud Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Suggested Books:

1. Sosinsky, B. (2010). Cloud Computing Bible. Wiley-India.
2. Buyya, R., Broberg, J., & Goscinski, A. M. (2011). Cloud Computing Principles & Paradigms. Wiley.

Reference Books:

1. Marinescu, D. C. (2013). Cloud Computing: Theory and Practice. Elviesier.
2. Hurwitz, J. S., Kirsch, D. (2020). Cloud Computing for Dummies. Wiley.

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	–	–	–	–	–	–	2
CO2	3	3	3	2	1	–	–	–	–	–	1	2
CO3	3	3	3	2	3	1	–	1	–	–	1	2
CO4	3	3	2	3	2	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Essence of Indian Knowledge Tradition

School	Birla School of Engineering and Technology
Programme	BTECH
Batch	2025-29
Branch/Discipline	BTECH
Semester	6
Course Title	Essence of Indian Knowledge Tradition
Course Code	CSET-6008
Credit	2
Course Type	Core Course
Course Objective	The subject aims to provide the student with: <ol style="list-style-type: none">1. The course aims at imparting basic principles of thought process, reasoning and inferencing.2. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.3. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of holistic health care system.
Course Outcome (COs)	Upon completion of the course, the students are expected to: CO 1. Demonstrate the concept of Traditional knowledge and its importance CO 2. Explain need and importance of protecting traditional knowledge. CO 3. Discuss various enactments related to the protection of traditional knowledge. CO 4. Explain the concepts of Intellectual property to protect the traditional knowledge. CO 5. Explain need of traditional knowledge in various sectors.

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.	CO1
UNIT2	PROTECTION OF TRADITIONAL: KNOWLEDGE the need for protecting traditional knowledge Significance of TK	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Protection, value of TK in global economy, Role of Government to harness TK.	
UNIT3	LEGAL FRAME WORK AND TK The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant, Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.	CO3
UNIT4	TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139	CO4
UNIT5	TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
2. "Knowledge Traditions and Practices of India" Kapil Kapoor¹, Michel Danino²

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	–	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

Practical Subjects

Machine Learning Lab

School	Birla School of Engineering & Technology
Programme	
Batch	2025-26
Branch/Discipline	B.Tech
Semester	
Course Title	Machine Learning Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. An understanding of basic concepts of Machine Learning. 2. An introduction to the fundamentals of Supervised Learning. 3. An understanding of Support Vector Machine. 4. An introduction to Evaluation. 5. An introduction to Unsupervised Learning. 6. An introduction to Deep Networks.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Understand the import and export of data using python.</p> <p>CO2. Demonstrate the various data pre-processing and dimension reduction methods</p> <p>CO3. Demonstrate the linear regression model and implement the different classification techniques</p> <p>CO4. Understanding the concept of Deep Neural Networks and Convolution Neural Network</p> <p>CO5. Understanding the concept and implementation of Genetic Algorithms</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Lab	Description	CO Mapping
Lab :1	Write a python program to import and export data using Pandas library functions	CO1
Lab :2	Demonstrate various data pre-processing techniques for a given dataset	CO2
Lab :3	Implement Dimensionality reduction using Principle Component Analysis (PCA) method.	CO2
Lab :4	Write a Python program to demonstrate various Data Visualization Techniques.	CO3
Lab :5	Implement Simple and Multiple Linear Regression Models.	CO3
Lab :6	Develop Logistic Regression Model for a given dataset.	CO3
Lab :7	Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.	CO4
Lab :8	Implement Naïve Bayes Classification in Python	CO5
Lab :9	Build KNN Classification model for a given dataset.	CO4
Lab :10	Build Artificial Neural Network model with back propagation on a given dataset.	CO4
Lab :11	Build CNN Model on given data set	CO4
Lab :12	Implementation of Genetic Algorithm	CO5

Evaluation:

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

Reference Books:

1. C. M. Bishop, (2010)Pattern Recognition and Machine Learning, Springer.
2. R. O. Duda, P. E. Hart, and D.G. Stork, (2012)Pattern Classification, John Wiley and Sons,.

3. CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	1	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Cloud Computing Lab

School	Birla School of Engineering & Technology
Programme	
Batch	2025-26
Branch/Discipline	B.Tech
Semester	
Course Title	Cloud Computing Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit – 1
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none">1. An understanding of cloud computing concepts and paradigms.2. Practical exposure to cloud service models (IaaS, PaaS, SaaS) and deployment models.3. Understanding virtualization, virtual machines, and data center resource management.4. Knowledge of cloud security practices and authentication mechanisms.5. Hands-on experience with cloud simulators such as CloudSim and GreenCloud.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Understand cloud computing components, benefits, and service models.</p> <p>CO2. Deploy and manage cloud resources using public/private cloud platforms.</p> <p>CO3. Implement virtualization concepts and manage virtual clusters.</p> <p>CO4. Apply cloud security practices and understand authentication, data privacy, and storage concerns.</p> <p>CO5. Develop cloud simulation experiments using CloudSim and GreenCloud.</p>

Course Outline

Lab	Description	CO Mapping
Lab 1	Explore cloud computing paradigms: Grid, Cluster, Distributed, Utility, and Cloud Computing using case studies.	CO1
Lab 2	Hands-on with public cloud platforms (AWS, Google Cloud, Microsoft Azure): Create virtual machines, storage accounts, and deploy simple applications.	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Lab 3	Setup private cloud using OpenStack or local virtualized environment; Deploy virtual instances.	CO2
Lab 4	Compare service models (IaaS, PaaS, SaaS) using practical examples and demonstrate usage scenarios.	CO2
Lab 5	Implement resource scaling using virtualization: Create VMs, monitor CPU, memory usage, and implement load balancing.	CO3
Lab 6	Practice virtual cluster management: Deploy multiple VMs and demonstrate cluster resource allocation.	CO3
Lab 7	Configure basic cloud security: Network, host, and application-level security; Implement authentication.	CO4
Lab 8	Implement data security and storage policies: Encrypt data at rest and in transit.	CO4
Lab 9	Explore Service Level Agreements (SLAs) and billing/accounting features in cloud platforms.	CO4
Lab 10	Introduction to CloudSim: Setup CloudSim environment, understand architecture, and run sample experiments.	CO5
Lab 11	Develop simulation experiments in CloudSim: Resource provisioning, VM allocation, and task scheduling.	CO5
Lab 12	Introduction to GreenCloud: Simulate energy-efficient cloud computing scenarios and evaluate results.	CO5

Text Books

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, *Cloud Computing: Principles and Paradigms*, Wiley, 2011.

Reference Books

1. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, *Cloud Computing: Concepts, Technology & Architecture*, 2nd Edition, Prentice Hall, 2013.
2. Rajkumar Buyya, Rodrigo N. Calheiros, X. Lu, *Introduction to CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms*.
3. **Evaluation:**

Mode of Evaluation	Laboratory	
Weightage	Continuous Evaluation	End Semester Examination
	60	40

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	–	–	–	–	2	2
CO2	3	3	3	2	3	1	–	–	–	–	2	2
CO3	3	3	3	2	3	1	–	1	–	–	2	2
CO4	3	3	2	3	3	1	–	1	1	–	2	2
CO5	3	3	3	3	3	2	1	2	2	2	2	3

B.TECH IN COMPUTER SCIENCE & ENGINEERING

VII Semester

Theory Subjects

Research methodology

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	
Branch/Discipline	Computer Science & Engineering
Semester	VII
Course Title	Research methodology
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	
Course Objective	<p>The subject aims to provide the student with:</p> <ul style="list-style-type: none">• Understand the fundamental concepts and importance of research methodology in computer science.• Formulate clear and researchable research questions.• Design and conduct research studies with appropriate methodologies.• Collect, analyze, and interpret research data using statistical and computational methods.• Communicate research findings effectively through academic writing and presentations.• Demonstrate ethical awareness and responsible conduct in research.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Define research and its significance in computer science.</p> <p>CO 2. Identify different types of research methodologies and select appropriate ones for specific research questions.</p> <p>CO 3. Develop a research design that includes data collection methods and ethical considerations.</p> <p>CO 4. Analyze research data using statistical software or programming languages.</p> <p>CO 5. Interpret research findings and draw valid conclusions.</p>

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outline

Unit	Description	CO Mapping
UNIT 1	<p>Introduction to Research Methodology</p> <p>Understanding Research: Definition and significance of research, Types of research, Research approaches: Quantitative vs. Qualitative, The role of research in computer science. Research Process and Ethics: Steps in the research process, Research ethics and responsible conduct, Formulating research questions and objectives, Research problem identification. Research Design and Sampling: Principles of research design, Types of research design, Sampling techniques, Choosing the appropriate research design.</p>	CO1
UNIT 2	<p>Quantitative Research Methods</p> <p>Data Collection and Measurement: Primary and secondary data, Data collection methods: Surveys, questionnaires, and observations, Measurement scales: Nominal, ordinal, interval, and ratio. Statistical Data Analysis: Measures of central tendency and variability, Data visualization techniques. Inferential Data Analysis: Hypothesis testing, Parametric and non-parametric tests, Statistical software tools.</p>	CO2
UNIT 3	<p>Qualitative Research Methods</p> <p>Qualitative Data Collection and Analysis: Qualitative research methods, Data collection techniques: Interviews focus groups, Coding and interpretation of qualitative data. Content Analysis: What is content analysis? Types of content analysis (e.g., thematic analysis, textual analysis), Conducting content analysis in computer science research, Using software for content analysis. Mixed-Methods Research and Reporting: Combining quantitative and qualitative methods, Reporting research findings, Ethical considerations in mixed-methods research</p>	CO3
UNIT 4	<p>Research Communication and Publishing</p> <p>Writing Research Papers: Structure of a research paper, Writing the abstract, introduction, literature review, and methodology sections, Citation and referencing.</p>	CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Research Presentations and Visualizations: Preparing effective research presentations, Visual aids and slide design, Presenting quantitative and qualitative findings Publishing Research: Journals vs. conferences, The peer-review process, Preparing manuscripts for submission, Ethical considerations in publishing including data privacy and security in publications.	
UNIT 5	Use of Encyclopaedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Textbook:

1. Research Methodology: Methods and Techniques, C.R. Kothari, New Age

Reference Books:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition

2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.

3. Research Methodology – C.R.Kothari

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	2	–	–	2	–	–	2	2	2
CO2	3	3	–	2	–	–	2	–	–	2	2	2
CO3	3	3	–	2	–	2	3	–	–	2	2	2
CO4	3	3	–	3	–	–	–	–	–	2	2	2
CO5	–	–	–	–	–	–	–	–	–	3	–	2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Internet of Things

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	2025-29
Branch/Discipline	Computer Science & Engineering
Semester	VII
Course Title	Internet of Things
Course Code	
Credit	L-T-P- 3-1-0 Total Credit - 4
Course Type	Core Course
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none">1. To gain a comprehensive understanding of the IoT ecosystem.2. To learn about IoT protocols, standardization efforts, M2M and WSN, SCADA and RFID protocols.3. To comprehend IoT architecture, open-source architecture (OIC), design principles, IoT devices and deployment models.4. To understand the differences between Web of Things and Internet of Things.5. To explore IoT applications for the industry, future factory concepts.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Demonstrate an understanding of the importance of the IoT ecosystem.</p> <p>CO2. Analyze and compare IoT protocols, including M2M and WSN.</p> <p>CO3. Design and implement an IoT architecture, including the OIC architecture and design principles.</p> <p>CO4. Evaluate and compare Web of Things (WoT) and Internet of Things (IoT) architectures.</p> <p>CO5. Develop and implement IoT applications for industry, including future factory concepts.</p>

Course Outline

Unit	Description	CO Mapping
UNIT1	IOT - What is the IoT and why is it important? Elements of an IoT ecosystem, Technolog, drivers, Business drivers,	CO1

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	Trends and implications, Overview of Governance, Privacy and Security, Issues.	
UNIT2	IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN, Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security	CO2
UNIT3	IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture &, Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.	CO3
UNIT4	WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web, – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.	CO4
UNIT5	IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

1. Honbo Zhou, (2012) “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), (2011) “Architecting the Internet of Things”, Springer.

Reference Books:

1. Vijay Madiseti and Arshdeep Bahga, (2014) “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT,

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	–	–	–	–	–	2	2
CO2	3	3	2	2	3	–	–	–	–	–	2	2
CO3	3	3	3	2	3	–	–	–	–	2	–	2
CO4	3	3	3	2	3	–	–	–	–	2	–	2
CO5	3	3	3	3	3	–	1	2	2	2	2	3

Entrepreneurship Development

School	Birla School of Engineering & Technology
Programme	
Batch	2025-29
Branch/Discipline	
Semester	
Course Title	Entrepreneurship Development
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	Core Course
Course Objective	<p>The subject aims to provide the student with:</p> <ul style="list-style-type: none">• Understand idea generation and will get creative and innovative skills• Differentiate between business opportunities and successful growth stories• Apply these concepts, to start an enterprise and design business plans that are suitable for funding by considering all dimensions of business.• Demonstrate entrepreneurial process by way of studying different case studies and find exceptions to the process

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Understand idea generation and will get creative and innovative skills</p> <p>CO 2. Differentiate between business opportunities and successful growth stories</p> <p>CO 3. Apply these concepts, to start an enterprise and design business plans that are suitable for funding by considering all dimensions of business</p> <p>CO 4. Demonstrate entrepreneurial process by way of studying different case studies and find exceptions to the process</p> <p>CO 5. Develop entrepreneurial skills through the preparation of a business plan and demonstrate innovative thinking for sustainable enterprise creation.</p>
-----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT1	<p>Foundations of Economics and Entrepreneurship</p> <p>This unit introduces the fundamental principles of economics and their relevance to entrepreneurship. It covers the definitions, nature and scope of economics, and distinguishes between microeconomics and macroeconomics. The theory of demand and supply is discussed in detail, including determinants, laws, and market equilibrium, along with the concept of elasticity—price, income, and cross elasticity. Students will also study the production function and factors of production such as land, labour, capital, and the entrepreneur. Cost concepts including fixed, variable, total, average, marginal and opportunity costs are introduced, followed by break-even analysis with numerical applications. The unit further explores the concept and definition of entrepreneurship, steps toward establishing a successful enterprise, and methods of opportunity identification and idea validation.</p>	CO1
UNIT2	<p>Market Structures and Business Environment</p> <p>This unit examines the business environment through an understanding of market structures and opportunities. It explains the meaning and characteristics of different types of markets including perfect competition, monopoly, monopolistic competition and oligopoly. The scope of e-commerce is highlighted as a modern entrepreneurial opportunity, covering various e-commerce models, the transformation of traditional businesses to online platforms, and the associated opportunities and limitations. The unit also explores the fundamentals of sales and marketing, the differences between them, and methods and models applied for products and services, with an emphasis on strategies for targeting international markets</p>	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT3	<p style="text-align: center;">Business Planning and Strategy</p> <p>This unit focuses on the process of transforming ideas into structured business plans. It includes the preparation of business plans, report writing for validating ideas, and techniques for presenting and pitching ideas to stakeholders. Students are introduced to project management methodologies and tools that assist in efficient execution and monitoring of entrepreneurial ventures. The establishment of standard operating procedures (SOPs) is emphasized, along with a detailed study of organizational structures and the roles of various positions within an enterprise.</p>	CO3
UNIT4	<p>Unit 4: Enterprise Formation, Growth and Governance</p> <p>This unit traces the journey of an enterprise from the idea stage to a fully scaled corporation. It explains different types of companies, their specifications, and the legal requirements for formation and governance. Students learn about legislation, compliance issues, and legal precautions necessary for entrepreneurs. The unit also discusses sources and stages of funding including seed capital, angel investment, and venture capital, as well as methods of collaboration, partnerships, mergers, and acquisitions. Finally, concepts of disinvestment and the liquidation or winding up of a company are presented to provide a comprehensive understanding of the enterprise lifecycle</p>	CO4
UNIT5	<p>Unit 5: Quality, Innovation and Project Work</p> <p>The final unit emphasizes quality, innovation and application. It introduces quality assurance standards, ISO certifications, and methods of examining product quality. Students are encouraged to think innovatively and sustainably in entrepreneurial activities. The unit culminates in project work where learners prepare and present a business plan or project report, undertake case studies, and demonstrate their entrepreneurial understanding through presentations.</p>	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books:

- 1 Entrepreneurship - Successfully Launching New Ventures by Bruce R. Barringer, R. Duane Ireland
- 2 Engineering Economics, R.Paneerselvam, PHI publication
- 3 Poornima M Charantimath, "Entrepreneurship development small business enterprises", Pearson

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Reference Books

- 1 Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins, S.P. and Decenzo David A.
- 2 Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
- 3 Principles and Practices of Management by L.M.Prasad

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	1	2	-	2	3	-	2
CO2	-	2	-	-	-	1	2	-	2	3	-	2
CO3	-	2	-	-	-	1	2	-	-	3	-	2
CO4	-	2	3	-	2	1	2	2	3	3	-	2

Practical Subjects

IoT Lab

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	
Branch/Discipline	Computer Science & Engineering
Semester	
Course Title	IoT Lab
Course Code	
Credit	L-T-P- 0-0-2 Total Credit - 1
Course Type	
Course Objective	<ol style="list-style-type: none">1. To familiarize students with IoT hardware, sensors, and microcontrollers.2. To gain hands-on experience with IoT protocols such as MQTT, CoAP, HTTP, and Zigbee.3. To implement IoT architectures and deployment models through open-source platforms.4. To design and test Web of Things applications and middleware.5. To develop small-scale IoT applications for industry use cases and smart environments.
Course Outcome (COs)	After completion of this course students will be able to: <ol style="list-style-type: none">1. CO 1. Identify and configure IoT devices, sensors, and basic connectivity modules.CO2. Implement and compare IoT

B.TECH IN COMPUTER SCIENCE & ENGINEERING

	<p>communication protocols for device-to-device and device-to-cloud interaction.</p> <p>CO3. Develop and test IoT architectures using open-source stacks and deployment models.</p> <p>CO4. Create and demonstrate applications integrating Web of Things (WoT) concepts.</p> <p>CO5. Build IoT applications for industrial and smart environments using real-time data.</p>
--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Lab Experiment 1: Familiarization with IoT Environment

1. Introduction to IoT ecosystem, hardware boards (Arduino/Raspberry Pi/ESP32).
2. Installation of Arduino IDE / Python for Raspberry Pi, and basic GPIO programming.

Lab Experiment 2: Working with Sensors and Actuators

1. Interfacing temperature and humidity sensors with microcontroller.
2. Controlling actuators (LED, buzzer, relay, motor) using sensor input.

Lab Experiment 3: Data Acquisition and Processing

1. Writing a program to collect data from multiple sensors.
2. Storing sensor data locally and performing simple analysis

Lab Experiment 4: IoT Protocols Implementation

1. Setting up MQTT broker and publishing/subscribing sensor data.
2. Demonstrating CoAP or HTTP communication with IoT devices.

Lab Experiment 5: Wireless Communication in IoT

1. Data transfer using Zigbee/Bluetooth modules.
2. Wi-Fi-based communication with IoT devices.

Lab Experiment 6: IoT Architecture and Deployment

1. Implementing IoT open-source architecture using IoTivity stack.
2. Demonstrating resource model and abstraction in IoTivity.

Lab Experiment 7: Web of Things Applications

1. Designing a simple web-based dashboard to display IoT sensor data.
2. Implementing a multitier WoT architecture using a middleware platform.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Lab Experiment 8: IoT Cloud Integration

1. Sending sensor data to a cloud platform (ThingSpeak/AWS IoT/Azure IoT Hub).
2. Visualizing IoT data on dashboards.

Lab Experiment 9: IoT Security Practices

1. Implementing authentication and data encryption in IoT communication.
2. Demonstrating secure communication between IoT devices.

Lab Experiment 10: IoT Applications

1. Smart Home: Temperature-based fan control / motion-based lighting system.
2. Smart Industry: Predictive maintenance use case using sensor data.
3. Smart Agriculture: Soil moisture monitoring and irrigation system.

Topic Beyond Syllabus

1. Implementing edge computing in IoT using Raspberry Pi.
2. AI/ML integration with IoT for anomaly detection.

Teaching Methods

- Hands-on demonstration and coding practice
- Case studies for each unit
- Mini project to be completed during the semester break

Text Books

1. Vijay Madisetti and Arshdeep Bahga, *Internet of Things (A Hands-on-Approach)*, 1st Edition, VPT, 2014.
2. Honbo Zhou, *The Internet of Things in the Cloud: A Middleware Perspective*, CRC Press, 2012.

Reference Books

1. Dieter Uckelmann, Mark Harrison, Florian Michahelles (Eds), *Architecting the Internet of Things*, Springer, 2011.
2. Raj Kamal, *Internet of Things: Architecture and Design Principles*, McGraw Hill, 2017.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	–	–	–	–	–	–	2
CO2	3	3	3	2	3	–	–	–	–	2	–	2
CO3	3	3	3	2	3	–	–	–	2	2	–	2
CO4	3	3	3	2	3	–	–	–	2	2	–	2
CO5	3	3	3	3	3	–	1	2	2	2	2	3

VIII Semester

Theory

Generative AI

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	
Branch/Discipline	Computer Science & Engineering
Semester	
Course Title	Generative AI
Course Code	
Credit	L-T-P- 3-0-0 Total Credit – 3
Course Type	PE
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none">1. An understanding of the foundations of Artificial Intelligence and Machine Learning concepts relevant to generative models.2. Knowledge of different generative AI models such as GANs, VAEs, and Transformer-based models.3. An ability to design, train and fine-tune generative models for various applications.4. Exposure to ethical, legal, and societal implications of generative AI technologies.5. Hands-on skills to apply generative AI in real-world domains such as text, image, audio, and video generation.

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Explain the basic principles of Artificial Intelligence and the role of generative models.</p> <p>CO2. Compare and contrast different generative AI techniques and their applications.</p> <p>CO3. Implement generative AI models such as GANs, VAEs, and Transformers.</p> <p>CO4. Analyze the performance of generative models and apply optimization techniques.</p> <p>CO5. Evaluate ethical concerns and justify responsible use of generative AI in real-world scenarios.</p>
-----------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to Generative AI – Overview of AI, ML, and DL; Evolution of Generative AI; Difference between Discriminative and Generative Models; Applications of Generative AI in industry.	CO1
UNIT2	Generative Models – Basics – Probability Distributions, Sampling Methods, Language Models; Variational Autoencoders (VAEs); Restricted Boltzmann Machines; Case Studies.	CO2
UNIT3	Generative Adversarial Networks (GANs) – Architecture of GANs; Training GANs; Types of GANs (DCGAN, CycleGAN, StyleGAN); Applications in Image and Video Generation	CO3
UNIT4	Transformer-based Generative Models – Attention Mechanism, Transformer Architecture, GPT, BERT vs GPT, Large Language Models (LLMs); Text-to-Image Models (DALL·E, Stable Diffusion).	CO4
UNIT5	Applications, Challenges and Ethics – Applications in text, audio, video, and design; Evaluation metrics (FID, BLEU, ROUGE); Ethical implications, bias, misinformation, copyright issues, Responsible AI practices.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Text Books

1. David Foster (2019), *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play*, O'Reilly Media.
2. Palash Goyal, Sumit Pandey, Karan Jain (2018), *Deep Learning for Natural Language Processing*, Apress.

Reference Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville (2016), *Deep Learning*, MIT Press.
2. Jakub Langr, Vladimir Bok (2019), *GANs in Action: Deep Learning with Generative Adversarial Networks*, Manning Publications.
3. Denis Rothman (2021), *Transformers for Natural Language Processing*, Packt Publishing.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2
CO3	2	2	3	1	3	-	-	-	-	-	2	2
CO4	-	-	-	-	-	2	1	-	-	-	-	3
CO 5	1	1	2	-	1	1	-	-	1	-	-	1

Augmented Reality & Virtual Reality

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	Augmented Reality & Virtual Reality
Branch/Discipline	Computer Science & Engineering
Semester	
Course Title	
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	PE

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. An introduction to the concepts, history, and evolution of AR and VR technologies. 2. Knowledge of AR/VR devices, hardware, software, and development platforms. 3. An understanding of interaction design, user experience, and rendering techniques in immersive systems. 4. Practical skills to design, model, and implement AR and VR applications. 5. Awareness of industry applications, challenges, and ethical considerations in AR/VR.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Describe the fundamental principles, evolution, and components of AR and VR systems.</p> <p>CO2. Compare AR/VR hardware, software frameworks, and development tools.</p> <p>CO3. Implement interactive 3D content for immersive experiences.</p> <p>CO4. Analyze user interaction and rendering pipelines for AR/VR applications.</p> <p>CO5. Evaluate industrial use cases, challenges, and ethical issues related to AR/VR deployment.</p>

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to AR and VR – Definitions, Evolution of AR/VR, Extended Reality (XR), Mixed Reality; Components of AR/VR Ecosystem; Applications across industries (education, healthcare, gaming, retail).	CO1
UNIT2	AR & VR Hardware and Software – AR devices (HoloLens, Magic Leap), VR devices (Oculus, HTC Vive); Motion tracking sensors, cameras, input devices; ARToolKit, ARCore, ARKit, Unity, Unreal Engine.	CO2
UNIT3	3D Interaction and Modeling – Scene graphs, 3D transformations, lighting and shading, rendering pipeline; Modeling tools (Blender, Maya); Interaction techniques: gaze, gesture, motion, haptics.	CO3
UNIT4	Immersive System Design – Principles of immersive design, UX in AR/VR, real-time rendering, performance optimization; Case studies in interactive applications.	CO3,CO4

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT5	Applications, Challenges and Ethics – AR/VR in healthcare, education, manufacturing, entertainment; Limitations: latency, motion sickness, cost; Ethical issues: privacy, psychological effects, data security.	CO5
--------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books

1. Alan B. Craig (2013), *Understanding Augmented Reality: Concepts and Applications*, Morgan Kaufmann.
2. Dieter Schmalstieg, Tobias Hollerer (2016), *Augmented Reality: Principles and Practice*, Addison-Wesley.

Reference Books

1. Grigore C. Burdea, Philippe Coiffet (2003), *Virtual Reality Technology* (2nd Ed.), Wiley-IEEE Press.
2. Tony Parisi (2015), *Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile*, O'Reilly Media.
3. John Vince (2019), *Virtual Reality Systems*, Pearson Education.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2
CO3	1	2	3	1	3	1	1	-	1	-	2	2
CO4	1	2	-	-	-	2	1	-	-	-	-	3
CO 5	1	-	1	1	-	1		-	-	-	-	1

Deep Learning

School	Birla School of Engineering & Technology
Programme	Bachelor of Technology (B.Tech)
Batch	
Branch/Discipline	Computer Science & Engineering

B.TECH IN COMPUTER SCIENCE & ENGINEERING

Semester	
Course Title	Deep Learning
Course Code	
Credit	L-T-P- 3-0-0 Total Credit - 3
Course Type	PE
Course Objective	<p>The subject aims to provide the student with:</p> <ol style="list-style-type: none"> 1. An understanding of the fundamentals of deep learning and neural networks. 2. Knowledge of different types of neural networks and their architectures. 3. Practical skills to implement and train deep learning models using frameworks such as TensorFlow and PyTorch. 4. The ability to apply deep learning techniques for real-world applications in computer vision, NLP, and time series analysis. 5. Awareness of optimization techniques, evaluation metrics, and ethical considerations in deep learning.
Course Outcome (COs)	<p>After completion of this course students will be able to:</p> <p>CO1. Explain the basic concepts of neural networks, activation functions, and gradient-based learning.</p> <p>CO2. Compare and contrast different types of neural networks including CNNs, RNNs, and GANs.</p> <p>CO3. Design, implement, and train deep learning models for classification, regression, and generative tasks.</p> <p>CO4. Evaluate model performance using appropriate metrics and optimization techniques.</p> <p>CO5. Analyze ethical issues, bias, and responsible deployment in deep learning applications.</p>

Course Outline

Unit	Description	CO Mapping
UNIT1	Introduction to Deep Learning – History of AI and ML, Overview of Deep Learning; Perceptron, Multi-Layer Perceptron (MLP); Activation functions; Forward and backward propagation; Loss functions and optimization.	CO1
UNIT2	Deep Neural Networks (DNNs) – Network architectures, regularization (dropout, batch normalization), initialization techniques; Training and hyperparameter tuning; Overfitting and underfitting.	CO2

B.TECH IN COMPUTER SCIENCE & ENGINEERING

UNIT3	Convolutional Neural Networks (CNNs) – Convolution and pooling layers, architectures (LeNet, AlexNet, VGG, ResNet); Applications in image classification, object detection, and segmentation.	CO3
UNIT4	Recurrent Neural Networks (RNNs) and Advanced Models – Vanilla RNNs, LSTM, GRU; Sequence modeling, time series prediction, NLP applications; Generative models and GANs overview	CO3,CO4
UNIT5	Deep Learning Applications and Ethics – Real-world applications in vision, NLP, speech, and robotics; Model evaluation metrics; Optimization techniques; Bias, fairness, interpretability, and ethical considerations.	CO5

Evaluation:

Mode of Evaluation	Theory	
Weightage	Continuous Evaluation	End Semester Examination
	40	60

Text Books

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville (2016), *Deep Learning*, MIT Press.
2. Francois Chollet (2017), *Deep Learning with Python*, Manning Publications.

Reference Books

1. Michael Nielsen (2015), *Neural Networks and Deep Learning*, Determination Press.
2. Charu Aggarwal (2018), *Neural Networks and Deep Learning: A Textbook*, Springer.
3. Sebastian Raschka, Vahid Mirjalili (2019), *Python Machine Learning*, Packt Publishing.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2
CO3	2	2	3	1	3	-	-	-	-	-	2	2
CO4	-	-	-	-	-	2	1	-	-	-	-	3
CO 5	1	1	2	1	2	1	1	-	-	-	-	1