BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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

Yelahanka, Bengaluru 560119

Bachelor of Engineering

Department of Information Science and Engineering

V Semester Scheme & Syllabus
2022 Scheme
Effective from the AY 2025-26

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Vision and Mission of the Department

Vision

Emerge as centre of learning in the field of information science & engineering with technical competency to serve the society.

Mission

To provide excellent learning environment through contemporary teaching methods, innovation, mentoring and industry institute interaction.

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Program Educational Objectives (PEOs)

PEOs	
PEO1	Successful professional career in Information Technology Industry.
PEO2	Pursue higher studies for contemporary knowledge in IT industry.
PEO3	Exhibit professionalism and team work with social concern.

Program Specific Outcomes (PSOs)

PSOs	
PSO-1	Apply the knowledge of information technology to develop software solutions.
PSO-2	Design and Develop hardware systems, manage and monitor resources in the product life cycle.

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

REVISED

Date: 18-12-2024

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

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

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

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

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

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

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

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

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

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

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

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

CoE 18/12/2024

Dean AA 18.12.24

Principal 18/12/24

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

Scheme of V Semester

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Information Science and Engineering Scheme of Teaching and Examinations – 2022 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2025-26 onwards)

Common to CSE/ISE

UG PROGRAM: B.E.ISE **Semester : V**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week					Examination				Credits
					L	T	P	S	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	HSMC	BCS501	Software Engineering and Project Management	TD: CSE PSB: CSE/ISE	3	0	0		3	50	50	100	3	3
2	IPCC	BCS502	Computer Networks		3	0	1		4	50	50	100	3	4
3	PCC	BCS503	Theory of Computation		3	1	0		4	50	50	100	3	4
4	PCCL	BCSL504	Web Technology Laboratory		0	0	1		1	50	50	100	3	1
5	PEC	BCS505X	Professional Elective Course I		3	0	0		3	50	50	100	3	3
6	PW	BCS506	Mini Project		0	0	3		3	50	50	100	3	3
7	AEC	BRMK507	Research Methodology and IPR	Any Department	2	0	0		2	50	50	100	3	2
8	MC	BESK 508	Environmental Studies	TD: CV PSB: CV	1	0	0		1	50	50	100	1	1
9	NCMC	BNSK509	National Service Scheme (NSS)	NSS Coordinator	0	0	0		0	100	-	100	-	0
		BPEK509	Physical Education (Sports and Athletics)	PED										
		BYOK509	Yoga	Yoga Teacher										
		BNCK509	National Cadet Corps (NCC)	NCC officer										
		BMUK509	Music	Music Teacher										
TOTAL										**500**	**400**	**900**	-	21

HSMC: Humanities, Social Sciences and Management Course, **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PCCL**: Professional Core Course laboratory, **PEC:** Professional Elective Course, **PW:** Project Work, **AEC**: Ability Enhancement Course, **MC:** Mandatory Course, **NCMC**: Non Credit Mandatory Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **S**: Self Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

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Professional Elective Course I			
Course Code	**Course Name**	**Course Code**	**Course Name**
BCS505A	Computer Vision	BCS505B	Artificial Intelligence
BCS505C	Advanced JAVA	BCS505D	Big Data Analytics
		BCS505E	Cybersecurity

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P : S) can be considered as (3: 0: 2 : 0) or (3: 2: 0: 0). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga/NCC/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), Yoga (YOG), National Cadet Corps (NCC) and Music with the concerned coordinator of the course during the beginning of each semester starting from III semester to VII semester. In every semester, students should choose any one mandatory course among the available 5 courses without repeating the course again. Activities shall be carried out in each of the semesters from III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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

Mini Project: The Mini Project Work is a part of the curriculum in the pre-final year. Mini Project is a course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a Mini- project can be assigned to a group having not more than 4 students. A comprehensive report is to be prepared after completion of the project work.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Software Engineering and Project Management (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS501	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 Theory	Exam Hours	03

Course Objectives:

This course aims to prepare the students to:

1. Outline software engineering principles in building a software.
2. Describe the process of requirement gathering, classification, specification and validation.
3. Understand various software system models and architecture.
4. Discuss various types of software testing practices.
5. Recognize the importance of Project Management and Planning.

Preamble:

Software Engineering refers to the systematic application of engineering approaches to the development of software. This course emphasizes essential principles, methodologies and practices of Software Engineering, requirement analysis to project management. Students will gain a comprehensive understanding of the software development life cycle and project management strategies.

Module – 1

Introduction: Professional software development, Software engineering ethics, case studies. **Software processes:** Software Process Models, Process activities.

Text Book 1: 1.1, 1.2,1.3, 2.1,2.2 **(6 Hours)**

Module – 2

Requirements Engineering: Functional and non-functional requirements, Requirements Engineering Processes, Requirements elicitation, Requirements specification, Requirements validation.

Agile Software Development: Agile methods, Agile development techniques.

Text Book 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 3.1, 3.2 **(8 Hours)**

Module – 3

System models: Context models, Interaction models, Structural Models, Behavioral Models; **Architectural design:** Architectural design decisions, Architectural views, Architectural Patterns.

Text Book 1: 5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3 **(10 Hours)**

Module – 4

Design and Implementation: Object-oriented design using UML

Software Testing: Development testing, Test-driven development, Release testing, User testing.

Text Book 1: 7.1,7.2, 8.1, 8.2, 8.3, 8.4 **(8 Hours)**

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Module – 5
Project management: Risk management, Managing people, Teamwork **Project planning:** Software pricing, Plan-driven development, Project scheduling **Text Book 1: 22.1, 22.2, 22.3, 23.1, 23.2, 23.3** **(8 Hours)**
Course Outcomes: The students will be able to: **CO1:** Apply software engineering principles, process models, and ethical practices to plan a software development project. **CO2:** Apply requirements elicitation and agile methods to develop Software Requirements Specification (SRS) document. **CO3:** Analyze context, interaction, and behavioral models to ensure alignment with software architectural requirements. **CO4:** Use UML-based design and test-driven development to implement and validate software components. **CO5:** Infer risk management and project scheduling practices to optimize software project outcomes.
Textbook: 1. **Ian Sommerville:** Software Engineering, 10th Edition, Pearson Education, 2021. **References:** 1. Roger. S. Pressman, Software Engineering-A Practitioners Approach, McGraw-Hill, 8th Edition, 2019. 2. Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publications, 2005. 3. Stephen R. Schacht, Object Oriented & Classical Software Engineering, Tata McGraw-Hill, 6th Edition, 2005
Continuous Comprehensive Assessment (CCA) suggested: 1. A Software Requirements Specification (SRS) document is a comprehensive written description that formally defines the functional and non-functional requirements for a software system. Students should submit a report on the mini project in the SRS format covering all the details specified in the SRS document. The evaluation will be done for 50 marks according to the rubrics and scaled down to 10. 2. Student is allowed to choose any MOOC Course related to the subject with a minimum duration of 25 hours. Student should submit the Course completion certificate and should take viva on the specific course for the award of marks.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

COMPUTER NETWORKS (3:0:1:0) 4

(Effective from the academic year 2025-26)

Course Code	BCS502	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:1:0	SEE Marks	50
Total Number of Contact Hours	40(Theory)+26(Practical)	Exam Hours	03

Course Objectives:

This course will enable students to: (List as per the requirement of your course)

1. Understand fundamentals of data communication networks
2. Explain routers, IP and Routing Algorithms in network layer
3. Discuss transport layer services and understand UDP and TCP protocols
4. Demonstration of application layer protocols

Preamble: This course provides an outline of network functions by introducing data communication and network concepts such as characteristics, functions, benefits, metrics, and attributes that describe network features and performance. In broad sense, Computer Networks are bringing fundamental transformation in our society from an industry economy to an information economy. Data Communications and Networking is an integral part of contemporary technologies and hence gained significance in engineering education. With constant upgrade in knowledge and skills Computer networking can lead to an exciting and rewarding career including the potential job opportunities such as Network Specialists, Network Technicians, Network administrators, Network analysts and Network solution Architects.

Module – 1

Data Communications: Data Communications Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Physical Layer: Data and Signals, Digital Signals, Transmission Impairment, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), PCM

Text book1 :Ch:1,2,3 **(08 Hours)**

Module – 2

Data Link Layer: Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Data link layer protocols, Stop and Wait, Go-Back-N, Selective repeat, Point to Point protocol (Framing, Transition phases only). Media Access control: Random Access, Controlled Access and Channelization

Text book 1Ch: 9,10,11 **(08 Hours)**

Module – 3

IPV4 Addresses, Internet Protocols: IPv4 and IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm

Text book 1: Chapter 18.4,18.4.1,18.4.2,18.4.3,19.1,19.1.1
TextBook2: Chapter 4.4.4,4.5,4.5.1,4.5.2 **(08 Hours)**

Module – 4

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Introduction to Transport layer services, Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Connection-Oriented Transport TCP: TCP Segment Structure, Round- Trip, Time Estimation and Timeout, TCP Connection Management, Principles of Congestion control, TCP Congestion Control

Text book 2: 3.1,3.3,3.5.2,3.5.3,3.5.6 **(08 Hours)**

Module – 5

Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Socket Programming

Text Book2: 2.1.1,2.1.2,2.1.5,2.2.1-,2.2.3, 2.3.1,2.4.12.4.3,2.4.4, 2.5.1-2.5.3,2.7(08 Hours)

Practical components for IPCC (add this only for IPCC courses)

Sl. No.	PART A FIXED SET OF EXPERIMENTS
1.	Implementation of Cyclic Redundancy Check for error correction and detection**.**
2.	Write a program for congestion control using leaky bucket algorithm.
3.	Write a program to find the shortest path between vertices using bellman-ford Algorithm.
4.	Implement a client Server program using TCP and UDP.
5.	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
6.	Simulate a four-node point-to-point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents, changing the parameter and determine the number of packets sent by TCP / UDP.
7.	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
8.	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

PART- B
OPEN ENDED EXPERIMENTS

1. Implement Flow control/ congestion control protocols using NS2/JAVA.
2. Demonstrate Routing Protocols of network layer.

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Course Outcomes:

The students will be able to:

CO1: Apply computer networking concepts for data communication.
CO2: Compare the services and protocols at different layer of network models.
CO3: Analyze algorithms for congestion control, routing and processes communication.
CO4: Demonstrate algorithms for different concepts of computer networks.

Textbooks:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill.
2. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth Edition, Pearson,2017 .

References:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts.
2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 6th Edition, Elsevier, 2007.

Continuous Comprehensive Assessment (CCA) suggested:

1. Demonstration and survey on network architecture of various organizations.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Theory of Computation (3:1:0:0) 4

(Effective from the academic year 2025-26)

Course Code	BCS503	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:1:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory) + 13 (Tutorial)	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Apply the core concepts in Automata and Theory of Computation
2. Design Grammars for context free languages
3. Prove theorems in automata theory using suitable properties
4. Design PDA and Turing machines for suitable languages

Preamble:

In this course, we delve into the elegant theories and intricate models that define what is computationally possible and impossible. From finite automata to Turing machines, from regular languages to undecidability, we explore the boundaries and capabilities of computation itself.

Module – 1

Introduction to Finite Automata:

Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata. Finite automata with Epsilon-transitions.

Text book : 1.5, 2.2, 2.3, 2.5 **(10 Hours)**

Module – 2

Regular expressions, Properties of Regular Languages: Finite Automata and Regular Expressions; Applications of Regular Expressions. Kleene's theorem. **Regular languages:** Proving languages not to be regular languages; Closure properties of regular languages; Equivalence and minimization of automata.

Text Book : 3.1, 3.2, 3.3, 4.1, 4.2, 4.4 **(10 Hours)**

Module – 3

Context-Free Grammars and Languages: Context–free grammars; Writing a grammar, Leftmost derivation, rightmost derivation, Parse Trees; Applications; Ambiguity in grammars and Languages.

Text Book: 5.1, 5.2, 5.3, 5.4 **(10 Hours)**

Module – 4

Properties of Context-Free Languages: Normal forms for CFGs. **Pushdown Automata:** Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata.

Text Book: 7.1, 6.1, 6.2, 6.3, 6.4 **(10 Hours)**

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Module – 5
Introduction to Turing Machine: Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers. **Recap:** Summary of the Course **Text Book: 8.1, 8.2, 8.3, 8.4, 8.6** **(10 Hours)**
Course Outcomes: The students will be able to: CO1: Make use of the concept of abstract machines and their power to recognize the languages. CO2: Apply the finite state machines for modeling and solving computing problems. CO3: Design grammars, PDA, Turing machine for formal languages. CO4: Analyze the relationship of language classes, grammar and automata.
Textbooks: 1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman ,Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd Edition, 2007 **References:** 1. Peter Linz, An Introduction to Formal Languages and Automata, 3rd Edition, Narosa Publishers, 1998. 2. K.L.P. Mishra, Theory of Computer Science, Automata, Languages, and Computation, PHI Learning, 3rd Edition, 2009. 3. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013. 4. John C Martin, Introduction to Languages and Automata Theory, Tata McGraw- Hill, 3rd Edition, 2007.
Continuous Comprehensive Assessment (CCA) suggested: 1. Problem-Solving based on real world Case Studies. 2. Gate Based Questions.

B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable from 2022 scheme

SEMESTER -V

Web Technology Laboratory (0:0:1:0) 1

(Effective from the academic year 2025-26)

Course Code	BCSL504	CIE Marks	50
Teaching Hours/Week (L: T:P:S)	0:0:1:0	SEE Marks	50
Total Number of Contact Hours	26(Practical)	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Illustrate the Semantic Structure of HTML and CSS
2. Compose forms and tables using HTML and CSS
3. Design Client-Side programs using JavaScript and Server-Side programs using PHP
4. Infer Object Oriented Programming capabilities of PHP.

Preamble: This course is intended to teach the basics involved in publishing content on the World Wide Web. This includes the fundamentals of how the Internet and the web function, and a general grounding introduction to more advanced topics such as programming and scripting. This will also expose students to the basic tools and applications used in Web technologies.

PART-A (List of Experiments)

1) Using HTML design a simple GUI interface to simulate a calculator to take the input from the user (Operands and operator). Implement the operations like addition, subtraction, multiplication and division using Javascript.

2) Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXTSHRINKING" in BLUE colour. Then the font size decreases to 5pt.

3) Write JavaScript to validate the following fields of the Registration page.
   a) First Name (Name should contains alphabets and the length should not be less than 6 characters).
   b) Password (Password should not be less than 6 characters length).
   c) E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
   d) Mobile Number (Phone number should contain 10

   Develop and demonstrate the usage of inline, internal and external style sheet using CSS.

4) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Programme, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

5) Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

6) Write the PHP programs to do the following:
   a) Implement simple calculator operations.
   b) Find the transpose of a matrix.
   c) Multiplication of two matrices.
   d) Addition of two matrices.

7) Write a PHP program named states.py that declares a variable states with value "Mississippi, Alabama Texas Massachusetts Kansas". Write a PHP program that does the following:

a) Search for a word in variable states that ends in xas. Store this word in element 0 of a list named states List.
b) Search for a word in states that begins with k and ends in s. Perform a case-insensitive comparison. Store this word in element1 of the list.
c) Search for a word in states that begins with M and ends in s. Store this word in element2 of the list.
d) Search for a word in states that ends in a. Store this word in element3 of the list.

8) Write HTML and PHP program to insert/delete/display student records in the database and display the appropriate message in the web page. (Design HTML interface for getting user choice to create/delete/display).

PART-B (Study Experiment / Project)

Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A. You can use any web technologies and frameworks and databases.

Course Outcomes:

The students will be able to:

CO1: Apply the concepts of mark-up language, CSS and JavaScript in developing dynamic web pages.
CO2: Analyse concepts of server side scripting using PHP for creating dynamic web pages.
CO3: Develop a web application project using HTML, CSS, JavaScript, PHP and database.

Textbooks:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271).
2. Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson Education, 2008. (Listed topics only from Chapters 1 to 9, 11 to 15).

Note:

1. In the examination each student picks one question from part A.
2. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.
3. A team of two or three students must develop the mini project.
4. However, during the examination, each student must demonstrate the project individually.
5. The team must submit a brief project report (20-30 pages).

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Mini project Report should be prepared in a standard format prescribed for project work.

Practical Examination Marks distribution:

a) **Part A:** Procedure + Conduction + Viva:10 + 35 +5 =50 Marks scale down to 30 Marks

b) **Part B:** Demonstration + Report + Viva voce = 25+15+10 = 50 Marks scale down to 20 Marks

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

COMPUTER VISION (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS505A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory)	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Understand the geometric relationships between 2D images and the 3D world.
4. Explore the principles of state-of-the-art deep neural networks.

Preamble:

Computer vision is an important applied research area encompassing aspects from geometry, machine learning, probabilistic models, optimization etc. The course consists of various important aspects of computer vision namely geometry, motion, image features, and low-level and high-level image labeling. The course is designed such that some fundamental frameworks as well as some contemporary methods are covered.

Module – 1

Introduction: What is computer vision? Image formation: Geometric primitives and transformations Photometric image formation , digital camera

Image processing: Point operators, Linear filtering, Non-linear filtering

Text book -1: **Chapter 1.1, Chapter 2, Chapter 3.1, 3.2, 3.3.1** **(8 Hours)**

Module – 2

Model fitting and optimization: Scattered data interpolation, Variation methods and regularization, Markov random fields.

Deep learning: Deep neural networks, Convolutional networks

Text book-1: Chapter 4.1, ,4.2, 4.3, 5.3,5.4 **(8 Hours)**

Module – 3

Recognition: Instance recognition , Image classification , Object detection, Semantic segmentation

Feature detection and matching: Contour tracking , Lines and vanishing points, Segmentation

Text book -1: 6.1,6.2, 6.3, 6.4,7.3, 7.4, 7.5 **(8 Hours)**

Module – 4

Computational photography: Image matting and compositing , Texture analysis and synthesis

Structure from motion and SLAM: Two-frame structure from motion, Multi-frame structure from motion, Simultaneous localization and mapping (SLAM)

Text book-1: **Chapter 10.4, 10.5, 11.3, 11.4, 11.5.** **(8 Hours)**

Module – 5

Depth estimation: Epipolar geometry, Sparse correspondence, Dense correspondence, Local methods, Global optimization, Multi-view stereo, Monocular depth estimation **3D reconstruction**: Model-based reconstruction, Recovering texture maps and albedos.

Text book-1: **Chapter 12 (except 12.6, 12.9), 13.6.13.7** **(8 Hours)**

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Course Outcomes:

The students will be able to:

CO1: Examine the concepts, terminology, theories in computer vision.

CO2: Apply various methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.

CO3: Analyze algorithms for object detection, recognition and tracking images .

CO4: Illustrate the concepts of computational photography, depth estimation, 3D reconstruction.

Text book:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Texts in Computer Science, 2nd edition, Springer Cham, published in 2022.

References:

1. Olivier Faugeras, "Three-Dimensional Computer Vision", Artificial Intelligence series, The MIT Press, ISBN: 9780262061582.
2. D.Forsyth and J.Ponce , "Computer Vision – A modern approach", Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

Continuous Comprehensive Assessment (CCA) suggested:

1. Students have to take certification program on advanced concepts of computer vision from MOOCS and demonstration with a Case Study.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Artificial Intelligence (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS505B	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40(Theory)	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving.
3. Get to know approaches of inference, perception, knowledge representation, and learning.

Preamble: Artificial Intelligence (AI) is a field with a rich history and solid foundations that have evolved over decades. Originating from early computational theories and the quest to create machines capable of mimicking human thought, AI has grown into a multifaceted discipline. To understand AI comprehensively, it is essential to gain a historical perspective, tracing its development from the pioneering work of Alan Turing and John McCarthy to the sophisticated systems of today. Familiarity with the basic principles of AI is crucial for addressing a wide range of problem-solving scenarios. These principles include algorithms, data structures, and computational complexity, which together form the backbone of AI applications. By applying these principles, AI systems can analyze data, recognize patterns, and make decisions with minimal human intervention.

Module – I

Introduction: What is AI, Foundations and History of AI. **Intelligent Agents:** Agents and Environment, Concept of Rationality, The Nature of Environment, The Structure of Agents.
Text book 1: Chapter 1 - 1.1, 1.2, 1.3, Chapter 2 - 2.1, 2.2, 2.3, 2.4 (8 Hours)

Module – II

Problem-solving: Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies: Breadth First Search, Uniform Cost Search, Depth First Search, Iterative Deepening Depth First Search.
Text book 1: Chapter 3 - 3.1, 3.2, 3.3, 3.4 (8 Hours)

Module – III

Informed Search Strategies: Heuristic Functions, Greedy best-first search, A* Search. Heuristic Functions. **Logical Agents:** Knowledge–Based Agents, The Wumpus World, Logic, Propositional logic, Propositional Theorem Proving.
Text book 1: Chapter 3 - 3.5, 3.6, Chapter 7 - 7.1, 7.2, 7.3, 7.4, 7.5 (8 Hours)

Module – IV

First Order Logic: Representation Revisited, Syntax and Semantics of First Order Logic, Using First Order Logic**. Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution
Text book 1: Chapter 8 - 8.1, 8.2, 8.3, Chapter 9 - 9.1, 9.2, 9.3, 9.4, 9.5 (8 Hours)

Module – V

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and Its Use, Naïve Bayes Models. Wumpus World Revisited. **Expert Systems:** Representing and using Domain Knowledge, ES Shells. Explanation,

Knowledge Acquisition.

Text Book 1: Chapter 12 - 12.1, 12.2, 12.3, 12.4, 12.5, 12.7,
Text Book 2: Chapter 20 - 20.1, 20.2, 20.3 and 20.4 **(8 Hours)**

Course outcomes:

CO1: Make use of the core principles of Artificial Intelligence, including intelligent agents and their environments to solve given problem.
CO2: Apply uninformed and informed search strategies to solve AI related problems.
CO3: Construct logical knowledge representations using propositional and first-order logic, and perform inference methods.
CO4: Analyze uncertainty in AI systems using probabilistic reasoning.
CO5: Illustrate the concept of AI and expert systems with knowledge-based applications.

Text books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 4th Edition, Pearson, 2022.
2. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2013.

References:

1. George FLugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011.
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980.
3. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Continuous Comprehensive Assessment (CCA) suggested:

1. Students have to take certification program on advanced concepts of AI from MOOCS and Demonstrate with a Case Study.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

ADVANCED JAVA (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS505C	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory)	Exam Hours	03

Course Objectives:

This course will enable students to: (List as per the requirement of your course)

1. Identify the need for advanced Java concepts like Enumerations and Collections
2. Adapt servlets to build server side programs
3. Make use of JDBC to access database through Java Programs
4. Demonstrate the use of Java concepts to develop component-based Java software

Preamble: This course enables the student to learn the advanced concepts of Java with Object Oriented Programming. They will be able to manipulate collections for real world problem with the usage of servlet and databases.

Module – 1

Enumerations, Autoboxing and Annotations(metadata):

Enumerations, Enumeration fundamentals, the values () and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

Text book 1: **Ch.12** **(8 Hours)**

Module – 2

The collections and Framework:

Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Why Generic Collections, The legacy Classes and Interfaces, Parting Thoughts on Collections.

Text Book 1: Ch.19 **(8 Hours)**

Module – 3

String Handling:

The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder

Text Book 1: Ch.17 **(8 Hours)**

Module – 4

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Life Cycle of a Servlet
Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Text Book 1: Ch. 35 **(8 Hours)**

Module – 5

The Concept of JDBC
JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.
Text Book 2: Ch. 06 **(8 Hours)**

Course Outcomes:

The students will be able to:
CO1: Apply the concepts of Collection framework and String handling to solve real-world problems.
CO2: Examine the applicability of Servlets and JSP to solve real world problems.
CO3: Implement various database operations for managing information using JDBC APIs.
CO4: Develop GUI based applications using Java Swings for event driven applications.

Textbooks:

1. Herbert Schildt: JAVA the Complete Reference, 11th Edition, Tata McGraw Hill, 2020.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2002.

References:

1. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.
2. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
3. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.

Continuous Comprehensive Assessment (CCA) suggested:
Each student has to solve one case study and demonstrate the working. Need to submit a brief report with suitable justification.

Case study-1:
An organization plans to develop a Management & Communication System in Java. The system will handle entity details, communication types, and message processing while focusing on code readability, maintainability, and adherence to best Java practices.

Case study-2
An organization wants to develop a Web-Based Information System using Java technologies. The application should allow users to submit and retrieve information via a browser interface, with proper request handling, session management, and database integration for persistent storage.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

BIG DATA ANALYTICS (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS505D	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory)	Exam Hours	03

Course Objectives:

1. Understand fundamentals of Big Data analytics
2. Explore the Hadoop framework and Hadoop Distributed File system
3. Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
4. Employ MapReduce programming model to process the big data
5. Use Spark and SparkStreaming for Real time data processing.

Preamble:

Big Data Analytics is required to deal with the problems faced by industry today. The techniques and tools are used to solve problems from a wide variety of Industries/Society such as manufacturing, services, retail, banking and finance, sports, pharmaceuticals, and aerospace etc.

Module – 1

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.

Text book 1: Chapter 1: 1.2 -1.7 **(8 Hours)**

Module – 2

Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools: Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

Text book 1: Chapter 2 :2.1-2.6 **(8 Hours)**

Module – 3

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.

Text book 1: Chapter 3: 3.1-3.7 **(8 Hours)**

Module – 4

MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.

Text book 1: Chapter 4: 4.1-4.6 **(8 Hours)**

Module – 5

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Spark: Introduction to Data Analysis with Spark, Programming using RDDs and MLIB, Data ETL, Information Reporting, Data visualization.
SparkStreaming: Data Stream Concepts and Data Stream Management, Stream Computing Aspects, Real Time Analytics Platforms.

Text book 1: Chapter 5 and 7: 5.2, 5.3,5.5,5.6, 7.2, 7.3,7.5 (8 Hours)

Course Outcomes:

The students will be able to:
CO1: Make use of the concepts of Big Data Analytics for variety of data generated.
CO2: Apply Big Data Computing models for solving the given problems.
CO3: Analyze the concepts of NoSQL, Mapreduce programming, Pig, Hive and Spark for the given scenario.
CO4: Choose appropriate big data tools to solve the given problem.

Textbooks:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2019 ISBN: 9789353164966, 9353164966.

References:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672.
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014ISBN-13: 978-8126551071.
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261.
4. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577.

Continuous Comprehensive Assessment (CCA) suggested:

1. MOOCS Certification on any Big Data Tools.
2. Demonstrate on any case study implementation using Big Data Tools.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Cyber Security (3:0:0:0) 3

(Effective from the academic year 2025-26)

Course Code	BCS505E	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40 (Theory)	Exam Hours	03

Course Objectives: This course will enable students to:

1. Understand the fundamental concepts of cybersecurity, cryptography, network security, and cloud security.
2. Develop practical skills in Cyber threat intelligence, Vulnerability Scanning and Data Protection.
3. Learn about cyber laws, compliance standards, and risk management frameworks.
4. Gain hands-on experience with security tools and real-world case studies.
5. Self-Learning for industry certifications such as CEH, CISSP, and Security+.

Preamble:

In today's digital age, network and cybersecurity are crucial for safeguarding information systems by ensuring data confidentiality, integrity, and availability. As cyber threats rapidly evolve, organizations and individuals must implement robust security measures to protect networks from malicious actors, unauthorized access, and data breaches. Understanding key principles such as secure communication protocols, firewalls, intrusion detection and prevention systems (IDS/IPS), and Virtual Private Networks (VPNs) is essential. Additionally, adopting cybersecurity frameworks, cryptographic techniques, and vulnerability management strategies strengthens defenses against cyber threats. By enforcing strong security policies, access controls, and proactive monitoring, we can establish a secure digital environment, fostering trust and reliability in cyberspace.

Module – 1

Importance of cyber security: Scenarios for security, Understanding the attack surface, the threat landscape, the importance of securing the network and Applications, the history of breaches, how security helps to build trust.

Legacy cybersecurity systems, Transformations in cybersecurity, Advancements in security technology to security 2.0, How ML and Al will play a larger role in cybersecurity.

(Chapter 1 & 2 from Textbook1) **(8 Hours)**

Module – 2

Learning cybersecurity Technologies Mobile security, advanced data security, cloud security, Modern day regulations, Incidence response and forensic, Enterprise security at scale, penetration testing, DevSecOps, IoT Security, User behavior analytics (UBA), Endpoint detection and response (EDR).

Attacker Mindset, the category of hackers, the traits of hackers, Social Characteristics of hackers, How hackers think (Motivators), What can be learned from the psychology of hackers.

(Chapter 3 & 5 from Textbook1) **(8 Hours)**

Module – 3

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Authentication: one-way authentication (password based, certificate based), Mutual authentication (shared secret based, Asymmetric key-based, Authentication and key Agreement, use of Timestamps), Dictionary attacks (attack types, defeating Dictionary attacks).
Firewalls: firewall basics-firewall functionality, policies and access control lists, firewall types; practical issues-placement of firewalls, firewall configuration.
Textbook 2: Chapter 11 (11.1-11.3), Chapter 21 (21.1- 21.2) (8 Hours)

Module – 4

Non-Cryptographic Protocol Vulnerabilities: DoS and DDoS (attack types, impact of SYN flooding), Session Hijacking and Spoofing (impersonation and session Hijacking, ARP spoofing); cross-site scripting (XSS): Vulnerabilities, SQL injection.
Intrusion Prevention and Detection: Introduction, Prevention versus Detection, Types of Intrusion Detection Systems,
Cyber Kill Chain: what is a kill chain, applying the cyber kill chain to detection

Textbook 2: Chapter 17 ,18,22 (17.1, 17.2, 18.4, 22.1- 22.4,)
Textbook 4: Chapter 16 (8 Hours)

Module – 5

Web Application Security: This Site Is Secure, The Core Security Problem: Users Can Submit Arbitrary Input, Key Problem Factors, The New Security Perimeter, Core Defense Mechanisms: Handling User Access, Handling User Input, Handling Attackers.

Penetration Testing of Web Applications: Using tools like BURP Suit and OWASP ZAP to find vulnerabilities in a web application.
https://portswigger.net/burp , https://owasp.org/
(Chapters 1 & 2 from TextBook 3) (8 Hours)

Course Outcomes:

The students will be able to:
CO1: Examine core cybersecurity concepts, threats, and frameworks to solve problems in threat detection and data protection.
CO2: Analyze hacker psychology and motivations to understand their influence on security strategies.
CO3: Analyze security mechanisms like firewalls, IDS/IPS, and authentication to address network security problems.
CO4: Investigate common network vulnerabilities and attacks to propose solutions and demonstrate defensive tools.

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Textbooks:

1. Cybersecurity: The Beginner's Guide by Dr. Erdal Ozkaya 1st Edition 2019, Published by Packt Publishing Ltd.
2. Bernard L. Menezes, Ravinder Kumar, **Cryptography, Network Security, and Cyber Laws**, 2018 Cengage Learning India Pvt. Ltd.
3. The Web Application Hacker's Handbook Finding and Exploiting Security Flaws by Dafydd Stuttard Marcus Pinto 2nd Edition 2011
4. Ira Winkler and Araceli Treu Gomes- Advanced Persistent Security, A Cyberwarfare Approach to Implementing Adaptive Enterprise Protection, Detection, and Reaction Strategies ISBN: 978-0- 12-809316-0 , Publisher: Todd Green

References:

1. Thoms J. Mowbray, Cybersecurity, managing systems, Conducting Testing, and Investigating Instrusions
2. The Cyber Security Body of Knowledge (CyBok)- Awais Rashid, Howard Chivers, George Danezis, Emil Lupu, Andrew Martin
3. Cybersecurity and Cyberwar" by P.W. Singer for policy/ethics or "Blue Team Handbook" for incident response
4. Sunit Belapure, Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives Wiley India Pvt Ltd 2013
5. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, Introduction to information security and cyber laws, Dreamtech Press 2015
6. Thomas J. Mowbray, Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions John Wiley & Sons 2013
7. James Graham, Ryan Olson, Rick Howard, Cyber Security Essentials CRC Press 2010

Tools for Cybersecurity Demonstration

1. OpenSSH, Hydra, Wireshark, Squid Proxy **(Module 3)**
2. MITRE ATT&CK Navigator, Metasploit Framework, Atomic Red Team, Snort, Hping3, UFONet , Nessus Essentials **(Module 4)**
3. BURP suite and OWASP Zap (**Module 5**)
4. Threat Modeling Tool, Threat Dragon, TMT (Threat Modeling Tool by IriusRisk) SIEM (Security Information and Event Management), Sysmon (Windows), OpenVAS, Nmap, Virus Total
5. **Indian Digital Signature Providers** –
    a. eMudhra
    b. SafeScrypt
    c. Capricorn CA
6. Autopsy, The Sleuth Kit (TSK), FTK Imager

Continuous Comprehensive Assessment (CCA) suggested:

1. **Practical demonstration of Tools in a team of two-three members choosing any 4-5 tools in the given list or any other tools in consultation with the course coordinator and report submission)**
    - Network Intrusion Detection and Analysis - (Tool: **Snort**)
    - Event Log Aggregation, Correlation, and analysis-(Tool: **Splunk Enterprises/IBM Qradar**)
    - Web Proxies – (caching, URI Filtering, Content Filtering, Squid Configuration, Squid Access Logfiles, Squid Cache, Web proxy analysis, Encrypted Web Traffic,)- (Tool: **Squid**)
    - Traffic Analysis – Protocol Analysis, Packet Analysis, Higher-layer Traffic analysis- (Tool: **Wireshark**)
    - Vulnerability Scanning and Management (Tools: **Nessus Essentials, Burp suite**)
    - Servers Configuration – DHCP server, Name servers, Authentication Servers, Firewalls, Application Servers
    - SMTP, Fishing Email Analysis – Tool: **Mx Toolbox, Virus Total, IP Void, URL Void, OpenVAS**

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- Incident response Management, Cyber Kill Chain, MITRE ATT&CK Framework
- AI-driven cyberattacks, zero-trust security models, blockchain for security, and deepfake threats
- Penetration testing, ethical hacking tools (Metasploit, Nmap, Aircrack-ng, etc.)
- Cyber laws (GDPR, HIPAA, India's IT Act), compliance frameworks.
- Incident response lifecycle (NIST SP 800-61), forensics tools (Autopsy, FTK).
- Risk management (ISO 27001, NIST CSF).

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Research Methodology and IPR (2:0:0:0)2

Common to all Branches

(Effective from the academic year 2025-26)

Course Code	BRMK507	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:0:0:0	SEE Marks	50
Total Number of Contact Hours	26 (Theory)	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Explain the research process and the research problem.
2. Gain knowledge on research design, sampling survey, and data collection.
3. Familiar with Interpretation and report writing.
4. Understand the concept of IP, patent, and copyright.
5. Enhance knowledge on trademarks, industrial, and IC layout design.

Preamble:

In the evolving landscape of academia, industry, and innovation, the importance of structured research methodology and awareness of intellectual property rights has become indispensable. This course aims to provide a comprehensive foundation in the principles, processes, and practices of scientific research while emphasizing the legal and ethical dimensions of knowledge protection.

Module – 1

Research Methodology: Meaning of Research, Objectives of research, types of research, research approaches, Significance of research, Research Process: Formulating research problem, Research methods versus methodology, Research and scientific method. Criteria of good research.

Defining the Research Problem: What is a Research Problem, Selecting the Research Problem, Necessity of Defining the Problem, and Techniques Involved in Defining a Problem.

Textbook1: Chapters 1 &2 **(06 Hours)**

Module – 2

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design. Research Design in the case of exploratory research studies, descriptive and diagnostic research studies. Basic Principles of Experimental Designs.

Design of Sample Survey: Sample Design: Objective, size of sample, parameter of interest, selection of a proper sample design. Sampling errors, non-sampling errors.

Data Collection: Experiments and Surveys, collection of primary data: observation method. Collection of secondary data. Selection of an appropriate method for data collection.

Textbook1: Chapters 3: 3.1-3.3,3.5.1-3.5.2, 3.6, Chapter 4: 4.1-4.3,& Chapter 6: 6.1-6.5 **(05 Hours)**

Module – 3

Interpretation and Report writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in interpretation, Significance of report writing, Different steps in report writing, layout of the research report, Types of reports, Oral presentation, Mechanics of writing research report, Precautions for writing a research report.

Textbook 1: Chapters 19 **(05 Hours)**

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Module – 4

Introduction to IP: Various forms of IP, Importance of intellectual property, Trade policy Reviews, Agreement on trips.
Patent: What is a patent, conditions for the grant of a patent, Temporal and spatial aspects of patent. right of the patentee, Patent Office, and the register of patents.
Copyright: What is Copyright , meaning of publication, ownership of copyright, license of copyright, term of copyright, Internet, and copyright issues.
Textbook 2: Chapters 1 : 1.1,1.2, 2 : 2.1, 2.3, 2.9, 2.11,2.12 & 4: 4.1,4.2,4.5,4.7,4.16

(05 Hours)

Module – 5

Trademarks: Introduction to trademark, term of trademark, collective marks, certification trademarks.
Industrial Design: Registration of Design: Non-registrable designs under The Design Act 2000, Conditions for registration of Industrial Designs. Term of Industrial Designs.
IC Layout Design: Integrated Circuits Layout Design, Grant of registration of IC Layout Design.
Textbook 2: Chapters 5 : 5.1,5.2,5.7 ,5.10,5.11 & 6 : 6.1-6.4,6.6 ,6.12

(05 Hours)

Course Outcomes:

The students will be able to:

CO1: Illustrate research process and research problem.
CO2: Describe research design, sampling survey, and data collection.
CO3: Explain the techniques of Interpretation and report writing.
CO4: Summarize the concept of IP, patent, and copyright.
CO5: Discuss trademarks, industrial, and IC layout design.

TEXTBOOKS:

1. CR Kothari and Gaurav Garg, Research Methodology, New Age International Publishers, Fifth Edition, 2024.
2. Neeraj Pandey, Khushdeep Dharni, “Intellectual Property Rights”, PHI Learning, 2014.

REFERENCES:

1. Dinakar Deb, Rajdeep Dey, Valentina, Engineering Research Methodology, Springer, 2019.
2. David V. Thiel, Research method for engineers, Cambridge University Press, 2014.
3. Prabhuddha Ganguli, “Intellectual Property Rights”, Tata McGraw–Hill, 2017.

Continuous Comprehensive Assessment (CCA) suggested:

1. A literature survey paper on any contemporary topic/problem can be carried out. Survey data analysis is the systematic examination of responses collected through surveys, using statistical or computational techniques to:
   - Identify trends and patterns
   - Summarize responses
   - Test hypotheses
   - Draw meaningful conclusions

2. Case Study Analysis (Group or Individual) involves selecting a topic related to a famous patent or copyright dispute and conducting a systematic investigation. The analysis should include background details, legal aspects, key stakeholders, dispute resolution process, and broader implications.

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B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER -V

Environmental Studies (1:0:0:0)1

Common to all Branches

(Effective from the academic year 2025-26)

Course Code	BESK508	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	1:0:0:0	SEE Marks	50
Total Number of Lecture Hours	13 (Theory)	Exam Hours	01

CREDITS: 01

Course objectives:

This course will enable students to

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Biodiversity: Types, Value, Hot spots and Threats. **(3 Hours)**

***Field work:** Visit to a local area to document environmental assets: River / Forest / Grassland / Hill

Module – 2

Environmental Pollution & Abatement & Relevant Acts: Water, Soil and Air Pollution. **(3 Hours)**

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, followed by observation and documentation of environmental pollution and recommendation of remedial measures.

Module – 3

Waste Management & Public Health Aspects & Relevant Acts: E-waste, Bio-medical & Hazardous wastes. **(3 Hours)**

***Field work:** Visit to a Resource Management Facility or Waste Treatment Facility, followed by understanding of process and its brief documentation.

Module – 4

Global Environmental Concerns: Ground water depletion, Climate Change and Carbon Trading. **(3 Hours)**

*Field work: Visit to a Green Building, followed by understanding of process and its brief documentation.

Module – 5

Latest Developments in Environmental Pollution Mitigation: E.I.A., E.M.S., SDG. **(3 Hours)**

*Field work: Visit to Environmental NGOs, followed by brief documentation.

Self-Study/Discussion on Case Studies**:** Environmental Stewardship

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*** Any one Field Work is to be successfully accomplished. The same will be assessed for CCA.**

Course outcomes:

The students will be able to:

CO1: Appraise the significance of ecological systems under the ambit of environment.

CO2: Analyze for the consequences owing from anthropogenic interactions on the environmental processes.

CO3: Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the interdisciplinary facets of environmental issues.

CO4: Elucidate the trans-national character of environmental problems and ways of addressing them.

CO5: Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Text Book:

1. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "Ecology, Environmental Science and Conservation", India, S. Chand Publishing, 2017.

References:

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996.

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