MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Information Science and Engineering

V & VI Semester Scheme and Syllabus

(2024 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

Information Science & Engineering

DEPARTMENT VISION

To excel in Information Science and Engineering by empowering students through innovative education, research and collaboration, shaping them into skilled and socially responsible professionals.

DEPARTMENT MISSION

1. To deliver quality education through innovative teaching, research and practical learning, preparing students to address global challenges.
2. To foster creativity, interdisciplinary knowledge and ethical leadership in a transformative learning environment.
3. To encourage lifelong learning and industry collaboration enabling students to thrive in a dynamic technology-driven world.
4. To nurture socially conscious professionals who contribute meaningfully to society and technological advancement.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

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. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze 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. (WK1, WK5, WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the 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

PO10: 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.

PO11: 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. (WK8)

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Skill and Knowledge:- To apply Basic and Contemporary Science, Engineering Experimental Skills to identify and solve problems in the industry and academia.

PEO2: Lifelong learning:- To establish as Practicing Professionals and sustain Lifelong Learning in the field of Information Technology.

PEO3: Attitudes:- To understand and follow Professional Ethics, Public Policy and Aesthetics to become better IT Professional.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Understand the principles of Information Science and Engineering and enrich knowledge in recent advancements and developments in Information Technology.

PSO2: Competent in programming and computing skills, ability to apply software development methodologies and modelling to solve real world problems in the field of Information Technology.

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V& VI Semester Common Courses

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Scheme of Teaching and Examinations -2024 Scheme

Outcome based Education (OBE) and Choice Based Credit System (CBCS) Effective from the Academic Year 2026-27

V Semester

S.No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Self-Learning	CIE Marks	SEE Duration in Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	HSMC	B24CS501	Software Engineering and Project Management	IS	3	0	0	3	50	3	50	100	3
2.	IPCC	B24CS502	Computer Networks	IS	3	0	2	3	50	3	50	100	4
3.	PCC	B24CS503	Theory of Computation	IS	2	2	0	2	50	3	50	100	3
4.	PCC	B24CS504	Artificial Intelligence	IS	3	0	0	3	50	3	50	100	3
5.	PCCL	B24CS505L	Artificial Intelligence Lab	IS	0	0	2	0	50	3	50	100	1
6.	PEC	B24YY56X	Professional Elective Course- I	CS & Allied	3	0	0	3	50	3	50	100	3
7.	BSC	B24BEK507	Biology for Engineers	IS / Che	2	0	0	2	50	2	50	100	2
8.	AEC	B24YY58X	Ability Enhancement Course Lab - V	CS & Allied	0	0	2	0	50	3	50	100	1
9.	NCMC	B24NCK59X	NSS / NCC / PE / Yoga / Music	HSS	2	0	0	0	100	-	-	100	PP
10.	NCMC	B24ESK510	Environmental Science and E-Waste Management	IS / CV	2	0	0	0	100	-	-	100	PP
11.	SDC	B24ISP511	Mini-Project	IS	0	0	4	0	50	3	50	100	2
								TOTAL	650		450	1100	22

BSC: Basic Science Course, HSMC: Humanity Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, PEC: Professional Elective Course, SDC- Skill Development Course, L: Lecture, T: Tutorial, P: Practical S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: Indicates common course to all the streams of engineering, PP/NP: Pass/ Not Pass, YY: Programme Code (EC, CS, IS etc.,), X: 1/2/3/4.

Professional Elective Courses (PEC) - I			
B24CS561	Computer Vision	B24IS562	Software Testing and Quality Assurance
B24IS563	Data Mining and Intelligent Information Systems	B24CS564	Distributed Computing
Ability Enhancement Course / Skill Enhancement Course (AEC/SEC) – V			
B24CS581	Angular JS Lab	B24CS582	Technical writing using Latex
B24IS583	Software Project Build and Deployment Lab	B24CS584	Computer Vision Lab
Non-Credit Mandatory Courses (NCMC)			
B24NCK591	National Service Scheme	B24NCK592	National Cadet Corps
B24NCK593	Physical Education	B24NCK594	Yoga
B24NCK595	Music		

National Service Scheme /National Cadet Corps/Physical Education/Yoga/Music: All the students have to register the same course namely National Service Scheme (NSS), National Cadet Corps(NCC), Physical Education (PE), Yoga (YOG) and Music (MUS) during the first week of III/IV/V/VI semesters. However, the option is given to students to change the activity. He/she may opt for the change of the course in ensuing semester. If the student is opting new course in V semester first time, he/she may take the basic modules from the syllabus to complete and if they repeat the same course in ensuing semester, subsequent modules can be offered.

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 PEC 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 student's strength for offering a professional elective is 10. However, this condition shall not be applicable to cases where the admission to the programme is less than 10 students.

HoD **Dean-Academics** **Principal**

VI Semester

S.No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical	Self-Learning	CIE Marks	SEE Duration Hrs	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC	B24IS601	Full Stack Development using Java	IS	2	2	0	2	50	3	50	100	3
2.	IPCC	B24IS602	Cloud Computing	IS	3	0	2	3	50	3	50	100	4
3.	PEC	B24YY63X	Professional Elective Course- II	CS & Allied	3	0	0	3	50	3	50	100	3
4.	OEC	B24YY64X	Open Elective Course - I	Any Dept	3	0	0	3	50	3	50	100	3
5.	PCCL	B24IS605L	Full Stack Development using Java Lab	IS	0	0	2	0	50	3	50	100	1
6.	AEC	B24RMK606	Research Methodology and IPR	IS / IC	1	0	0	1	50	1	50	100	1
7.	SDC	B24PRJ607	Capstone Project work : Phase - I	IS	0	0	4	0	100	-	-	100	2
8.	AEC	B24YY68X	Ability Enhancement Course Lab – VI	CS & Allied	0	0	2	0	50	3	50	100	1
9.	NCMC	B24NCK69X	NSS / NCC / PE / Yoga / Music	HSS	2	0	0	0	100	-	-	100	PP
10.	HSMC	B24IKK610	Indian Knowledge System	IS	2	0	0	0	100	-	-	100	PP
								TOTAL	600		400	1000	18

HSMC: Humanity Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, PEC: Professional Elective Course, OEC: Open Elective Course, SDC- Skill Development Course, L: Lecture, T: Tutorial, P: Practical S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: Indicates common course to all the streams of engineering, PP/NP: Pass/ Not Pass, YY: Programme Code (EC, CS, IS etc.,), X: 1/2/3/4

Professional Elective Courses (PEC) - II			
B24IS631	Foundation of Quantum Computing	B24IS632	Data Driven Modeling
B24AI633	Exploratory Data Analysis	B24IS634	Advanced Database Management Systems
Open Elective Course (OEC)- I			
B24CS641	Introduction to Data Structures	B24IC642	Introduction to Cyber Security
B24CS643	Fundamentals of Operating Systems	B24AI644	AI for Everyone
Ability Enhancement Course (AEC) – VI			
B24AI681	Explainable AI	B24AI682	Generative AI
B24IS683	Software Testing Automation	B24CS684	REACT
Non Credit Mandatory Course (NCMC)			
B24NCK691	National Service Scheme	B24NCK692	National Cadet Corps
B24NCK693	Physical Education	B24NCK694	Yoga
B24NCK695	Music		

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

CIE Procedure for Project Work: The CIE marks shall be awarded by a committee consisting of the Head of the concerned department and two senior faculty members of the department, one of whom shall be the Guide. The CIE marks awarded for the project work shall be based on the evaluation of the **Project Work Report, Project Reviews and Viva-Voce.** The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the Institution. The SEE marks awarded for the project work shall be based on the evaluation of **Project Demonstration, Project Presentation and Viva-Voce** in the ratio 20:60:20.

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

HoD **Dean-Academics** **Principal**

Semester-V					
Software Engineering and Project Management **Category: HSMC** **(Common to CSE, CSD, CSE(IC), AIML, ISE)**					
Course Code	:	**B24CS501**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers.
2.	To describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
3.	To recognize the importance of Project Management with its methods and methodologies.
4.	To identify software quality parameters and quantify software using measurements and metrics.
5.	To list software quality standards and outline the practices involved.

Module – 1	**No.of Hrs**
Software and Software Engineering: The nature of Software, The unique nature of WebApps,Software Engineering, The software Process, Software Engineering Practice, Software Myths. **Process Models:** A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models,Concurrent models, Specialized process models. Unified Process , Personal and Team process models.	9
Module – 2	**No.of Hrs**
Understanding Requirements: Requirements Engineering, Establishing the ground work, Eliciting Requirements, Developing use cases, Building the requirements model, Negotiating Requirements,Validating Requirements. **Requirements Modeling Scenarios, Information and Analysis classes**: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts, Class-Based Modeling. **Requirement Modeling Strategies** : Flow oriented Modeling , Behavioral Modeling.	9
Module – 3	**No.of Hrs**
Agile Development: What is Agility?, Agility and the cost of change. What is an agile Process?, Extreme Programming (XP), Other Agile Process Models, A tool set for Agile process . **Principles that guide practice**: Software Engineering Knowledge, Core principles, Principles that guide each framework activity.	9
Module – 4	**No.of Hrs**
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives,Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices. **Project Evaluation:** Evaluation of Individual projects, Cost–benefit Evaluation Techniques, Risk Evaluation.	9
Module – 5	**No.of Hrs**
Software Quality: Introduction, The place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, product versus process quality management.	9

Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models.	

Course Outcomes: At the end of the course, the students will be able to	
CO1	Differentiate process models to judge which process model has to be adopted for the given scenarios.
CO2	Derive both functional and nonfunctional requirements from the case study.
CO3	Analyze the importance of various software testing methods and agile methodology.
CO4	Illustrate the role of project planning and quality management in software development.
CO5	Identify appropriate techniques to enhance software quality.

Text Books	
1.	Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2.	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
Reference Text Books	
1.	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.
2.	"Software Engineering: Principles and Practice", Hans van Vliet, Wiley India, 3rd Edition, 2010.

Web links and Video lectures (e-Resources)
1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg01/preview

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -V					
Computer Networks **Category: IPCC** **(Common to CSE, CSD, CSE(IC), AIML, ISE)**					
Course Code	:	**B24CS502**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:2:3	SEE	:	50 Marks
Total Hours	:	45+30	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand fundamental concepts of computer networks, including network applications, hardware, software, and reference models such as OSI and TCP/IP.
2.	To explain the functions and technologies of the Physical Layer**,** including transmission media, wireless communication, PSTN, and mobile communication systems.
3.	To analyze Data Link Layer mechanisms**,** covering error detection and correction, flow control, sliding window protocols, Ethernet, and wireless LAN technologies.
4.	To describe Network and Transport Layer operations, including routing algorithms, congestion control, IPv4/IPv6, Quality of Service (QoS), and transport protocols like TCP and UDP.
5.	To demonstrate knowledge of Application Layer protocols, such as DNS, HTTP, FTP, SMTP, SNMP, and Telnet, and understand how network services support real-world applications.

Module – 1	**No. of Hours**
Introduction: Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, frame relay. **The Physical Layer:** Guided transmission media, wireless transmission, the public switched telephone networks, mobile telephone system.	9
Module – 2	**No. of Hours**
Data Link Layer: Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE **Medium Access Sub layer:** multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth	9
Module – 3	**No. of Hours**
Network Layer: Network layer design issues, routing algorithms, Congestion control algorithms, Internetworking, the network layer in the internet (IPv4 and IPv6), Quality of Service.	9
Module – 4	**No. of Hours**
Transport Layer: Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP and TCP.	9
Module – 5	**No. of Hours**
Application Layer: Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. **Application Layer Protocols:** Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamentals of computer networks, network models (OSI, TCP/IP), and different types of network applications.
CO2	Analyze the functions of the Physical Layer, including transmission media, wireless communication, PSTN and mobile communication systems.
CO3	Apply Data Link Layer concepts such as error detection and correction, flow control, sliding window protocols, and multiple access techniques.
CO4	Evaluate Network Layer and Transport Layer protocols, including routing algorithms, congestion control, IPv4/IPv6, TCP, and UDP.
CO5	Demonstrate the working of Application Layer services and protocols such as DNS, HTTP, FTP, SMTP, SNMP, and Telnet in real-world networking scenarios.

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	List Of Experiments
1.	Write a program to implement CRC (Cyclic Redundancy Check) for error detection.
2.	Write a program to implement Hamming Code for error detection and correction.
3.	Write a program to simulate Flow Control using Stop-and-Wait Protocol.
4.	Write a program to simulate Sliding Window Protocol.
5.	Write a program to implement Leaky Bucket Algorithm for traffic shaping
6.	Write a program to implement Token Bucket Algorithm.
7.	Write a program to Create a TCP server and client to exchange messages.
8.	Write a program to Implement connectionless communication between client and server.
9.	Write a program to Implement error detection using CRC.
10.	Write a program to Detect and correct single-bit errors
11.	Write a program to Basic error detection technique.
12.	Write a program to Control data transmission rate.

Text Books

Reference Text Books	
1.	Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India
2.	Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India
1.	1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi,

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30** (Average of Best Two Assessments)	**50/2 = 25**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	Any One Assessments as per regulations	**20**	**20**	
Laboratory	**Lab conduction & Record**	Evaluating each expt. for 10 marks.	**05**	**25**
	Lab Internal Test	**50**	**20**	
Continuous Internal Evaluation (CIE)				**50**
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.
8. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -V					
Theory of Computation **Category: PCC** **(Common to CSE, CSE(IC), CSD, ISE)**					
Course Code	:	**B24CS503**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	2:2:0:2	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To explain the concepts of Deterministic and Non-Deterministic Finite Automata.
2.	To demonstrate the use of Regular Expressions for constructing DFA and NFA
3.	To illustrate the construction of Context-Free Grammar for a given language.
4.	To narrate advanced computing Machines such as PDA and Turing Machine

Module – 1	**No. of Hours**
Finite Automata (FA): Introduction, Alphabets; Languages; strings; Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Nondeterministic Finite Automata (NFA) - Definition of NFA, language of an NFA, Equivalence of Deterministic	9
Module – 2	**No. of Hours**
Non-deterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions,. Regular Expressions (RE): Minimization of Deterministic Finite Automata, Introduction to Regular Expression, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions,	9
Module – 3	**No. of Hours**
Converting Regular Expressions to Automata, Applications of Regular Expressions. Equivalence of finite automata and regular expressions; pumping lemma for regular languages; Regular Grammars, Context Free Grammars and Normal Forms: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA.	9
Module – 4	**No. of Hours**
Context Free Grammars; Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's; Normal forms-CNF and GNF.	9
Module – 5	**No. of Hours**
Push Down Automata (PDA): Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. Turing Machines (TM): Formal definition and behavior, Languages of a TM, Problems.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Construct the Finite State Machine by applying the concepts of DFA, NFA and Epsilon-NFA.
CO2	Identify ambiguity in Grammar and Construct CFG for the given language in Normal Forms.
CO3	Apply the concepts of Push down Automata and Turing machine for a given Language.
CO4	Classify a problem for different models of Computation.
CO5	Recognize skills in formal reasoning and reduction of a problem to a formal model.

Text Books	
1.	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2009.
2.	Peter Linz, An Introduction to formal Languages and Automata, 4th Edition, Jones and Bartlett Publishers, 2006.

Reference Text Books	
1.	Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson, 2009.

2.	B N Srinivasa Murthy, Formal Languages and Automata Theory, Sanguine Publishers, 2006.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Artificial Intelligence **Category: PCC** **(Common to CSE, CSD, ISE)**					
Course Code	:	**B24CS504**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To study about uninformed and Heuristic search techniques.
2.	To learn techniques for reasoning under uncertainty.
3.	To introduce Machine Learning and supervised learning algorithms.
4.	To study about ensembling and unsupervised learning algorithms.
5.	To learn the basics of deep learning using neural networks.

Module – 1	**No.of Hrs**
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.	9
Module – 2	**No.of Hrs**
Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search.	9
Module – 3	**No.of Hrs**
Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic.	9
Module – 4	**No.of Hrs**
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	9
Module – 5	**No.of Hrs**
Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
CO2	Compare various Searching and Inferencing Techniques.
CO3	Develop knowledge base sentences using propositional logic and first order logic.
CO4	Describe the concepts of quantifying uncertainty.
CO5	Use the concepts of Expert Systems to build applications.

Text Books	
1.	Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson,2015.
2.	Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition,Tata McGraw Hill,2013.
Reference Text Books	
1.	George F Lugar, 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.

Web links and Video lectures (e-Resources)
1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409

3. https://nptel.ac.in/courses/106/105/106105077

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment-1	50	30 (Average of Best two Assessments)	50
	Internal Assessment-2	50		
	Internal Assessment-3	50		
AAT	Two Assessments as per regulations	20	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Artificial Intelligence Lab **Category: PCCL** **(Common to CSE, CSD, ISE)**					
Course Code	:	**B24CS505L**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To implement fundamental Artificial Intelligence and Machine Learning algorithms.
2.	To apply supervised and unsupervised learning techniques on real-world datasets.
3.	To design and evaluate classification, regression, and clustering models.
4.	To analyze the performance of AI and ML algorithms.
5.	To develop problem-solving skills using AI and ML tools and techniques.

Sl. No	**List of Experiments**
1.	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem.
2.	Implement and Demonstrate Best First Search Algorithm on Missionaries-Cannibals Problems using Python.
3.	Implement A* Search algorithm.
4.	Implement AO* Search algorithm.
5.	Solve 8-Queens Problem with suitable assumptions.
6.	Implementation of TSP using heuristic approach.
7.	Implementation of the problem- solving strategies: either using Forward Chaining or Backward Chaining.
8.	Implement resolution principle on FOPL related problems.
9.	Implement Tic-Tac-Toe game using Python.
10.	Build a bot which provides all the information related to text in search box.
11.	Implement any Game and demonstrate the Game playing strategies.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Implement and demonstrate AI and ML algorithms
CO2	Evaluate different algorithms
CO3	Build supervised learning models
CO4	Build ensembling and unsupervised models
CO5	Build deep learning neural network models

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	Lab Conduction & Record	Evaluating each expt. for 10 marks	20	50
	Laboratory Test -1	50	15	
	Laboratory Test -2	50	15	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hour

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -V					
Computer Vision **Category: PEC- I**					
Course Code	:	**B24CS561**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the fundamentals of computer vision and digital image processing
2.	To introduce the processes involved image enhancement and restoration.
3.	To facilitate the students to gain understanding color image processing and morphology
4.	To impart the knowledge of image segmentation and object recognition techniques

Module – 1	**No. of Hours**
Introduction: What is computer vision? A brief history. **Image Formation**: Photometric image formation, The digital camera. Image processing: Point operators, Linear filtering.	9
Module – 2	**No. of Hours**
Image processing: More neighborhood operators, Fourier transforms, Pyramids and wavelets, and Geometric transformations.	9
Module – 3	**No. of Hours**
Image Restoration and Reconstruction: A model of Image degradation/restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering. **Image Segmentation**: Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only), Segmentation by region growing & region splitting & merging.	9
Module – 4	**No. of Hours**
Color Image Processing: Color fundamentals, color models, Pseudocolor image processing, full color image processing, color transformations, color image smoothing and sharpening, Using color in image segmentation, Noise in color images.	9
Module – 5	**No. of Hours**
Morphological Image Processing: Preliminaries, Erosion and Dilation, opening and closing, Hit-or-miss transform, some basic morphological algorithms. **Feature Extraction:** Background, Boundary preprocessing (Boundary following & Chain codes only). **Image pattern Classification:** Background, Patterns and classes, Pattern classification by prototype matching (Minimum distance classifier only).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamentals of computer vision and its applications.
CO2	Apply the image enhancement techniques for smoothing and sharpening of images
CO3	Compare the different image restoration and segmentation techniques
CO4	Demonstrate the smoothing and sharpening techniques for color images.
CO5	Explain morphological, feature extraction, and pattern classification techniques for object recognition.

Text Books	
1.	Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2nd Edition, 2022, Springer.
2.	Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Pearson, 4th edition, 2019

Reference Text Books	
1.	David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015..
2.	ReinhardKlette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -V					
Software Testing and Quality Assurance **Category: PEC-I**					
Course Code	:	**B24IS562**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the fundamentals of software quality, software testing, and quality assurance principles.
2.	To identify and apply appropriate software testing techniques and strategies for different phases of the software life cycle
3.	To analyze software at various levels of testing, including unit, integration, system, and acceptance testing
4.	To evaluate software quality metrics and implement processes for defect management, verification, and validation
5.	To utilize modern testing tools and automation frameworks to improve software quality and testing efficiency.

Module – 1	**No. of Hours**
Definition of quality, software quality assurance (SQA) and software quality control (SQC),Quality models and standards: ISO 9000, McCall's quality factors, quality characteristics, Software Development Life Cycle (SDLC) and Software Testing Life Cycle (STLC),Objectives of testing, testing principles, Roles in QA & testing teams, Basic terminologies: error, defect, fault, failure	9
Module – 2	**No. of Hours**
Black-box, White-box, and Grey-box testing techniques, Static v/s dynamic testing, Test case design techniques, Equivalence partitioning, Boundary value analysis, Decision tables, Test planning and documentation, Test execution & reporting	9
Module – 3	**No. of Hours**
Unit testing, Integration testing (Incremental, Top-down, Bottom-up, Big Bang), System testing, Acceptance testing, Regression testing, Non-functional testing: load, stress, performance, usability, security, compatibility	9
Module – 4	**No. of Hours**
Verification and validation, Quality assurance activities throughout SDLC, Defect management, Software metrics: Process metrics, Product metrics, Defect metrics, Reliability models and measurement, Root cause analysis, Maturity models (e.g., Testing Maturity Model)	9
Module – 5	**No. of Hours**
Test automation fundamentals, Test automation frameworks, Selecting tools (e.g., Selenium, JUnit, TestNG), CI/CD and continuous testing, Test reporting & defect tracking tools (e.g., JIRA, Bugzilla), Case studies & industry best practices, Emerging topics (e.g., AI in SQA, DevOps integration)	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the concepts of software quality, quality assurance, and the role of testing in the software development lifecycle.
CO2	Design test cases using black-box, white-box, and grey-box testing techniques.
CO3	Apply testing strategies at different levels (unit, integration, system, and acceptance) and perform regression testing effectively.
CO4	Measure software quality using metrics, analyze defects, and suggest improvements in processes for better software reliability
CO5	Implement automated testing using popular tools (e.g., Selenium, JUnit, TestNG) and integrate testing into CI/CD pipelines for real-world software projects.

Text Books	
1.	**Software Testing and Quality Assurance: Theory and Practice** – by KshirasagarNak and PriyadarshiTripathy
2.	**Software Quality Engineering: Testing, Quality Assurance & Quantifiable Improvement** – Jeff Tian

Reference Text Books	
1.	**Software Quality Assurance: From Theory to Implementation** – Daniel Galin
2.	**Foundations of Software Testing** – by Aditya P. Mathur (suggested for deeper testing concepts)

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Data Mining and Intelligent Information System **Category: PEC-I**					
Course Code	:	**B24IS563**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Learning Objective is	
1.	To teach the basic principles, concepts and applications of data mining.
2.	To introduce the task of data mining as an important phase of knowledge recovery process
3.	To learn the important concepts and algorithms in IIS
4.	To understand the data/file structures that are necessary to design, and implement intelligent information (IIS) systems.
5.	To Explore applications of intelligent systems like recommendation engines, predictive analytics, and decision support systems.

Module– 1	**No. of Hours**
Introduction: Basics of Natural Language Processing, Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications. **Language Modeling**: Statistical Language Model - N-gram model (unigram, bigram), Paninion Framework, Karaka theory.	9
Module– 2	**No. of Hours**
Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of Speech Tagging. **Syntactic Analysis:** Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.	9
Module– 3	**No. of Hours**
Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.	9
Module– 4	**No. of Hours**
Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval -Custer model, Fuzzy model, LSTM model**,** Major Issues in Information Retrieval. **Lexical Resources**: WordNet, FrameNet, stemming and lemmatization, Parts-of-Speech Tagger, Research Corpora.	9
Module– 5	**No. of Hours**
Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply fundamental concepts of NLP and language modeling techniques.
CO2	Model morphological analysis and parsing using finite state and grammar-based approaches.
CO3	Develop Naïve Bayes–based models for text classification and sentiment analysis.
CO4	Apply information retrieval and lexical semantic techniques for natural language understanding.
CO5	Identify and explain machine translation techniques using encoder–decoder models.

Text Books	
1.	Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press in 2008. Reprint in 2014, 2021.
2.	Daniel Jurafsky, James H. Martin, “Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2023.

Reference Text Books	
1.	Akshay Kulkarni, Adarsha Shivananda, “Natural Language Processing Recipes -Unlocking Text Data with

	Machine Learning and Deep Learning using Python", Apress, 2019.
2.	V Geetha, "Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", Pearson, 2024.
3.	Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer Academic Publishers.

Web links and Video lectures (e-Resources)
• https://www.youtube.com/watch?v=M7SWr5xObkA
• https://youtu.be/02QWRAhGc7g
• https://www.youtube.com/watch?v=CMrHM8a3hqw
• https://onlinecourses.nptel.ac.in/noc23_cs45/preview
• https://archive.nptel.ac.in/courses/106/106/106106211/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE FOR THE THEORY:

1. Three tests each of 50 marks, after the completion of the syllabus 40%, 70% and 100% respectively.
2. Average of best two internal assessment tests each of 50 marks, scale down to 30 marks.
3. Any two assessment methods as per regulations i.e. Two assignments / Two Quizzes/ Weekly test / project work for 40 marks, scaled down to 20 marks.
4. Total marks scored (30+20 = 50 marks).
5. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50).

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping:

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

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Semester-V					
Distributed Computing **Category: PEC - I**					
Course Code	:	**B24CS564**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the computation and communication models of distributed systems.
2.	To illustrate the issues of synchronization and collection of information in distributed systems.
3.	To describe distributed mutual exclusion and distributed deadlock detection techniques.
4.	To elucidate agreement protocols and fault tolerance mechanisms in distributed systems.
5.	To explain the cloud computing models and the underlying concepts.

Module– 1	**No.ofHrs**
Introduction: Definition-Relation to Computer System Components –Motivation – Message - Passing Systems versus Shared Memory Systems –Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.	9
Module– 2	**No.ofHrs**
Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.	9
Module– 3	**No.ofHrs**
Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agarwala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.	9
Module– 4	**No.ofHrs**
Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -- Algorithm for Asynchronous Checkpointing and Recovery	9
Module– 5	**No.ofHrs**
Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the foundations of distributed systems
CO2	Solve synchronization and state consistency problems
CO3	Use resource sharing techniques in distributed systems
CO4	Apply working model of consensus and reliability of distributed systems
CO5	Explain the fundamentals of cloud computing

Text Books	
1	Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
2	Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc- Graw Hill Publishers, 1994.
Reference Text Books	
1	George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2	Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3	Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007. 4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/106106107
2 https://onlinecourses.nptel.ac.in/noc25_cs84/preview
3. https://www.coursera.org/courses?query=distributed%20computing

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3- High, Level 2- Moderate, Level 1-Low

Semester-V					
Angular JS Lab **Category: AEC - V**					
Course Code	:	**B24CS581**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To learn the basics of Angular JS framework.
2.	To understand the Angular JS Modules, Forms, inputs, expression, data bindings and Filters
3.	To gain experience of modern tool usage (VS Code, Atom or any other] in developing Web applications

Sl. No	**Name of the Programs / List of the experiments**
1.	Develop Angular JS program that allows user to input their first name and last name and display their full name. Note: The default values for first name and last name may be included in the program.
2.	Develop an Angular JS application that displays a list of shopping items. Allow users to add and remove items from the list using directives and controllers. Note: The default values of items may be included in the program
3.	Develop a simple Angular JS calculator application that can perform basic mathematical operations (addition, subtraction, multiplication, division) based on user input.
4.	Write an Angular JS application that can calculate factorial and compute square based on given user input
5.	Develop AngularJS application that displays a details of students and their CGPA. Allow users to read the number of students and display the count. Note: Student details may be included in the program
6.	Develop an AngularJS program to create a simple to-do list application. Allow users to add, edit, and delete tasks.Note: The default values for tasks may be included in the program
7.	Write an AngularJS program to create a simple CRUD application (Create, Read, Update, and Delete) for managing users.
8.	Develop AngularJS program to create a login form, with validation for the username and password fields
9.	Create an AngularJS application that displays a list of employees and their salaries. Allow users to search for employees by name and salary. Note: Employee details may be included in the program
10.	Create AngularJS application that allows users to maintain a collection of items. The application should display the current total number of items, and this count should automatically update as items are added or removed. Users should be able to add items to the collection and remove them as needed. Note: The default values for items may be included in the program
11.	Create AngularJS application to convert student details to Uppercase using angular filters. Note: The default details of students may be included in the program
12.	Create an Angular JS application that displays the date by using date filter parameters

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop Angular JS programs using basic features
CO2	Develop dynamic Web applications using Angular JS modules
CO3	Make use of form validations and controls for interactive applications
CO4	Consume RESTful APIs and integrate with backend services.
CO5	Use Angular JS best practices for performance optimization and testing.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**20**	**50**
	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 3 hour.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Technical writing using LATEX **Category: AEC-V**					
Course Code	:	**B24CS582**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0 : 0 : 2 : 0	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the computation and communication models of distributed systems.
2.	To illustrate the issues of synchronization and collection of information in distributed systems.
3.	To describe distributed mutual exclusion and distributed deadlock detection techniques.
4.	To elucidate agreement protocols and fault tolerance mechanisms in distributed systems.
5.	To explain the cloud computing models and the underlying concepts.

Sl. No	**List of Experiments**
1.	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.
2.	Develop a LaTeX script to create a document that displays the sample Abstract/Summary
3.	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting
4.	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry
5.	Develop a LaTeX script to create a document that contains the following table with proper labels. **Sl.No** | **USN** | **Student Name** | **Subject 1** | **Subject 2** | **Subject 3** 1 | 4XX22XX001 | Name 1 | 89 | 60 | 90 2 | 4XX22XX002 | Name 2 | 78 | 45 | 98 3 | 4XX22XX003 | Name 3 | 67 | 55 | 59
6.	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept
7.	Develop a LaTeX script to create a document that consists of the following two mathematical equations $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$ $= \frac{-2 \pm \sqrt{4+32}}{2}$ $\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \mathrm{sgn}(\pi)\varphi_\sigma^\lambda \varphi_\pi^\lambda$ $= \sum_{\tau \in C_{\sigma t}} \mathrm{sgn}(\sigma^{-1}\tau\sigma)\varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$ $= A_{\sigma t}\varphi_\sigma^\lambda$
8.	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries,

	and lemmas in the document
9.	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section
10.	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library
11.	Develop a LaTeX script to present an algorithm in the document using lgorithm/algorithmic/algorithm2e library
12.	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply basic LaTeX command to develop simple document.
CO2	Develop LaTeX script to present the tables and figures in the document.
CO3	Illustrate LaTeX script to present theorems and mathematical equations in the document.
CO4	Develop programs to generate the complete report with citations and a bibliography.
CO5	Illustrate the use of Tikz and algorithm libraries to design graphics and algorithms in the document.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**20**	**50**
	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Software Project Build and Deployment Lab **Category: AEC-V**					
Course Code	:	**B24IS583**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the software build lifecycle and deployment processes
2.	To use version control tools like Git for managing source code.
3.	To implement build automation using tools like Maven, Gradle, or npm scripts.
4.	To deploy software projects on servers or cloud environments.
5.	To apply CI/CD pipelines and containerization for automated deployment

Sl. No.	**List of the experiment**
1.	Git Installation and Repository Setup
2.	**Version Control Basics:** Initialize Git repo, commit changes, push to GitHub
3.	**Branching and Merging:** Create feature branches, merge them into main branch
4.	**Build Automation – Java Project :** Use Maven or Gradle to build a Java project, handle dependencies
5.	**Build Automation – Node.js Project :** Use npm scripts to build Node.js project
6.	**Unit Testing and Build Integration:** Run unit tests automatically during build
7.	**Deployment on Local Server :** Deploy a web application on local Apache Tomcat / Node server
8.	**Deployment on Remote Server:** Deploy application on cloud VM / AWS EC2 / Azure VM
9.	**Docker Containerization :** Containerize a project using Docker, run container locally
10.	**Docker Compose / Multi-container Setup :** Deploy multi-container applications (e.g., backend + database)
11.	**CI/CD Pipeline :** Set up GitHub Actions / Jenkins pipeline to build, test, and deploy automatically
12.	**Cloud Deployment using AWS / Azure:** To deploy a simple application on cloud platform.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Manage software project code using Git and GitHub
CO2	Build software projects using build automation tools
CO3	Deploy software applications on local/remote servers
CO4	Containerize applications using Docker and run containers
CO5	Implement basic CI/CD pipelines for automated builds and deployments

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks	Eligibility
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks*12 expts.**	**20**	**50**	**40% of 50 = 20**
	Laboratory Test -1	**50**	**15**		
	Laboratory Test -2	**50**	**15**		
Continuous Internal Evaluation (CIE)				**50**	**20**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

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

Level 3 – High, Level 2 – Moderate, Level 1 -Low

Semester-V					
Computer Vision Lab **Category: AEC-V**					
Course Code	:	**B24CS584**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To get an idea of how to build a computer vision application with Python language.
2.	To learn the basic image handling and processing
3.	To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
4.	To get an idea of how to implement the image transforms.
5.	To understand various image segmentation algorithms.

Sl. No.	**List of the experiment**
1.	Image Loading, Exploring and displaying an Image.
2.	Access and Manipulate of Image Pixels.
3.	Image Transformations. i) Resizing ii) Rotation
4.	Addition operation of Two Images.
5.	Image filtering operations i) Mean Filtering ii) Gaussian Filtering
6.	Image Binarization Using Simple Thresholding method.
7.	Edge Detection operation using Sobel and Scharr Gradients.
8.	Find Grayscale and RGB Histograms of an Image.
9.	Segment an Image using K-means Clustering algorithm.
10.	Write a program to classify an Image using KNN Classification algorithm.

Course Outcomes: At the end of the course, the students will be able to	
CO1	To develop and implement the image loading and exploring
CO2	To Evaluate the image transforms
CO3	To apply and analyze for image processing denoising algorithms
CO4	To design and develop the Image Segmentation using Edge detection
CO5	To apply and analyze image clustering and classification algorithms

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**20**	**50**
	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

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

Level 3 – High, Level 2 – Moderate, Level 1 -Low

Semester -V					
Mini - Project **Category: SDC**					
Course Code	:	**B24ISP511**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:4:0	SEE	:	50 Marks
Total Hours	:	60	Total	:	100 Marks
Credits	:	2	SEE Duration	:	3 Hrs

Mini-Project Work Evaluation:

Mini Project is a hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small applications etc. Based on the ability/abilities of the student/s and recommendations of the supervisor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project: (i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the **Project Reviews, Project report and Viva-Voce in the ratio of 60:20:20**. The marks awarded for the project report shall be the same for all the batches mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

CIE Evaluation: The CIE marks awarded for the Mini-project, shall be based on the evaluation of the **Project Reviews, Project report and Viva-Voce in the ratio of 60:20:20**. The marks awarded for the project report shall be the same for all the batches mates.

SEE Evaluation: SEE for project work will be conducted by the two examiners appointed by the Principal / CoE. The SEE marks awarded for the project work shall be based on the evaluation of **Write-up, Presentation Skills, Project Demonstration and Viva-Voce** in the ratio of 20:60:20

Rubrics for Mini-Project

Sl. No	**Criteria**	**Scale of Assessment**		
		Satisfactory (0-5)	**Good (6-8)**	**Excellent (9-10)**
1	Objective, Existing method with proposed method	Incomplete justification to the objectives proposed; Steps are mentioned but unclear; without justification to objectives	Good justification to the objectives; Methodology to be followed is specified but detailing is not done	All objectives of the proposed work are well defined. Steps to be followed to solve the defined problem are clearly specified.
2	Analysis/Description of the project	Incomplete explanation of the key concepts and in-sufficient description of the technical requirements of the project	Complete explanation of the key concepts but in-sufficient description of the technical requirements of the project	Complete explanation of the key concepts and strong description of the technical requirements of the project

3	Result Analysis	• All defined objectives are achieved. • Modules are working well in isolation and properly demonstrated • Modules of project are not properly integrated.	• All defined objectives are achieved. • Each module working well and properly demonstrated. • Integration of all modules not done and system working is not very satisfactory.	• All defined objectives are achieved. • Each module working well and properly demonstrated • All modules of project are well integrated and system working is accurate
4	Project Report	• Project report is according to the specified format but some mistakes. • In-sufficient references	• 1. Project report is according to the specified format. • References are appropriate but not mentioned well.	• Project report is according to the specified Format. • References are appropriate and well mentioned
5	Queries	Lacks sufficient knowledge and awareness	Fair knowledge and awareness related to the project.	Extensive knowledge and awareness related to the project

Semester -VI					
Full Stack Development using Java **Category: PCC**					
Course Code	:	**B24IS601**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the fundamentals of full stack development and web application architectures.
2.	To develop skills in designing responsive and interactive front-end interfaces using modern web technologies.
3.	To provide knowledge of server-side development using Java-based frameworks and technologies.
4.	To understand database concepts and integrate backend applications with databases.
5.	To familiarize students with full stack integration, deployment practices, and basic security concepts.

Module – 1	**No. of Hours**
Introduction to Full Stack Development: Overview of Full Stack Development, Client–Server Architecture, Web application architecture (Monolithic, MVC, Microservices), Frontend, Backend and Database roles, Introduction to Web Technologies, Basics of HTTP/HTTPS, URLs, Web servers and Application servers, Introduction to Java ecosystem for web development	9
Module – 2	**No. of Hours**
Front-End Development: HTML5 structure, forms and multimedia elements, CSS3 styling, layouts, Flexbox and responsive design, JavaScript fundamentals including variables, functions, events and DOM manipulation, ES6 features	9
Module – 3	**No. of Hours**
Back-End Development using Java: Core Java concepts for web development, Java Servlet architecture, Servlet lifecycle and request–response handling, JavaServer Pages (JSP), MVC pattern in Java web applications, Introduction to Spring Framework, Spring Boot basics, RESTful web services using Spring Boot.	9
Module – 4	**No. of Hours**
Database and Integration: Database concepts and normalization, SQL basics and CRUD operations, Overview of MySQL and PostgreSQL, JDBC architecture and database connectivity, ORM concepts, Hibernate and JPA basics, Backend and database integration, Exception handling and logging	9
Module – 5	**No. of Hours**
Full Stack Integration, Deployment, and Security: Frontend and backend integration, REST API consumption, Authentication and authorization concepts, Session management, Web application security fundamentals, Introduction to DevOps concepts, Deployment basics on local servers and cloud platforms, Mini full stack project development.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of full stack development, client–server architecture, and web application architectures.
CO2	Design responsive and interactive user interfaces using HTML, CSS, and JavaScript.
CO3	Develop server-side applications using Java technologies such as Servlets, JSP, and Spring Boot.
CO4	Implement database operations and integrate backend applications using SQL, JDBC, and ORM frameworks.
CO5	Integrate frontend and backend components, deploy full stack applications, and address basic security challenges.

Text Books	
1.	**Head First Servlets and JSP** – Bryan Basham, Kathy Sierra, Bert Bates, *O'Reilly Media*.
2.	**Spring in Action** – Craig Walls, *Manning Publications*.

Reference Text Books	
1.	**Spring Start Here: Learn Spring Framework and Spring Boot** – Practical guide for mastering Spring and Spring Boot, ideal for backend and RESTful services.
2.	**Murach's Java Servlets and JSP** – In-depth reference for learning Servlets and JSP for Java web application development.
3.	**Java Servlet Programming** – Classic reference focused on core servlet programming concepts for Java web development

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment-1	50	30 (Average of Best two Assessments)	50
	Internal Assessment-2	50		
	Internal Assessment-3	50		
AAT	Two Assessments as per regulations	20	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
Cloud Computing **Category: IPCC**					
Course Code	:	**B24IS602**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:2:3	SEE	:	50 Marks
Total Hours	:	45+30	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the rationale behind the cloud computing revolution and the business drivers
2.	To understand various models, types and challenges of cloud computing
3.	To understand the design of cloud native applications, the necessary tools and the design tradeoffs
4.	To realize the importance of Cloud Virtualization, Abstraction`s, Enabling Technologies and cloud security

Module – 1	**No. of Hours**
Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.	9
Module – 2	**No. of Hours**
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.	9
Module – 3	**No. of Hours**
Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.	9
Module – 4	**No. of Hours**
Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security **Cloud Security and Trust Management:** Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.	9
Module – 5	**No. of Hours**
Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe various cloud computing platforms and service providers.
CO2	Illustrate the significance of various types of virtualization.
CO3	Identify the architecture, delivery models and industrial platforms for cloud computing based applications.
CO4	Analyze the role of security aspects in cloud computing.
CO5	Demonstrate cloud applications in various fields using suitable cloud platforms.

LABORATORY

Practical Component of IPCC

Sl. No	Name of the experiments
1.	Creating a Virtual Machine: Configure and deploy a virtual machine with specific CPU and memory requirements in Google Cloud. OR Exploring AWS CloudShell and the AWS Cloud9 IDE
2.	Getting Started with Cloud Shell and gcloud: Discover the use of gcloud commands to manage Google Cloud resources from Cloud Shell. OR Working with Amazon S3Orchestrating Serverless Functions with AWS Step Functions
3.	**Cloud Functions**: Create and deploy a Cloud Function to automate a specific task based on a Cloud Storage event. OR Working with Amazon DynamoDB
4.	**App Engine**: Deploy a web application on App Engine with automatic scaling enabled. OR Developing REST APIs with Amazon API Gateway
5.	**Cloud Storage: Qwikstart: Google** Cloud Storage provides scalable and secure object storage for managing data, accessible via the Cloud Console or gsutil CLI. OR Creating Lambda Functions Using the AWS SDK for Python
6.	Cloud SQL for MySQL: Discover how Google Cloud SQL for MySQL provide automated management and high availability for MySQL databases? OR Migrating a Web Application to Docker Containers
7.	**Cloud Pub/Sub:** Experiment how Google Cloud Pub/Sub facilitate real-time messaging and communication between distributed applications. OR Caching Application Data with ElastiCache, Caching with Amazon CloudFronT, Caching Strategies
8.	**Multiple VPC Networks:** Explore benefits of using multiple VPC networks in Google Cloud for organizing and isolating resources. OR Implementing CloudFront for Caching and Application Security
9.	**Cloud Monitoring:** Discover how Cloud Monitoring help in tracking and analyzing the performance and health of cloud resources? OR Orchestrating Serverless Functions with AWS Step Functions
10.	Kubernetes Engine: Qwik Start: Deploy a containerized application to a Kubernetes Engine cluster. OR Automating Application Deployment Using a CI/CD Pipeline

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30** (Average of Best Two Assessments)	**50/2 = 25**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	Any One Assessments as per regulations	**20**	**20**	

Laboratory	**Lab conduction & Record**	Evaluating each expt. for 10 marks.	**05**	**25**
	Lab Internal Test	**50**	**20**	
Continuous Internal Evaluation (CIE)				**50**
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice. Students should answer five full questions, selecting one full question from each module.
5. Students have to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
6. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
7. Question papers to be set as per the Blooms Taxonomy levels.
8. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
Fundamentals of Quantum Computing **Category: PEC-II**					
Course Code	:	**B24IS631**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Learning Objective is	
1.	To understand the basic concepts of quantum computation including qubits, quantum gates, and quantum circuits.
2.	To apply mathematical tools of quantum mechanics to represent quantum states and analyze composite quantum systems.
3.	To explore and implement quantum algorithms and circuits, including controlled operations and universal gate sets
4.	To understand and utilize the Quantum Fourier Transform (QFT) and its applications in quantum algorithms
5.	To gain insight into the physical realization of quantum computers and current technologies for implementing qubits.

Module– 1	**No. of Hours**
Qubits, quantum computation, single/multiple qubit gates, quantum circuits, Bell states, teleportation, Deutsch/Deutsch-Jozsa algorithms	9
Module– 2	**No. of Hours**
Postulates of quantum mechanics, measurements, composite systems, density operator, entanglement, EPR, Schmidt decomposition, superdense coding	9
Module– 3	**No. of Hours**
Controlled operations, universal quantum gates, computational complexity	9
Module– 4	**No. of Hours**
Quantum Fourier Transform, phase estimation, factoring	9
Module– 5	**No. of Hours**
Physical realization of quantum computers (optical photons, cavity QED, etc.)	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Represent quantum information mathematically using qubits, density matrices, and standard quantum notations (Dirac notation).
CO2	Design and analyze quantum circuits with single- and multi-qubit gates and perform basic quantum operations such as teleportation and superdense coding
CO3	Apply quantum algorithms, including Deutsch and Deutsch–Jozsa, and understand their implementation on quantum circuits.
CO4	Implement Quantum Fourier Transform for solving problems like phase estimation and integer factoring, and understand its computational significance
CO5	Explain various physical implementations of quantum computers and evaluate different approaches for realizing qubits in practical systems

Text Books	
1.	**Michael A. Nielsen & Isaac L. Chuang**, *Quantum Computation and Quantum Information*, 10th Anniversary Edition, Cambridge University Press, 2010.
Reference Text Books	
1.	**Michael A. Nielsen & Isaac L. Chuang**, *Quantum Computation and Quantum Information*, 10th Anniversary Edition, Cambridge University Press, 2010.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping:

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

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Semester -VI					
Data Driven Modeling **Category: PEC-II**					
Course Code	:	**B24IS632**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the fundamental concepts and techniques of machine learning.
2.	To understanding of various types of machine learning and the challenges faced in real world applications.
3.	To familiarize the machine learning algorithms such as regression, decision trees, Bayesian models, clustering, and neural networks.
4.	To explore advanced concept like reinforcement learning and provide practical insight into its applications.
5.	To enable students to model and evaluate machine learning solutions for different types of problems.

Module – 1	**No. of Hours**
Introduction: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications. Understanding Data – 1: Introduction, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization.	9
Module – 2	**No. of Hours**
Understanding Data – 2: Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Feature Engineering and Dimensionality Reduction Techniques. Basic Learning Theory: Design of Learning System, Introduction to Concept of Learning, Modelling in Machine Learning. Chapter-2 (2.6-2.8, 2.10),	9
Module – 3	**No. of Hours**
Similarity-based Learning: Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR). Regression Analysis: Introduction to Regression, Introduction to Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression. Decision Tree Learning: Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms.	9
Module – 4	**No. of Hours**
Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model, Naïve Bayes Algorithm for Continuous Attributes. Artificial Neural Networks: Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Networks, Popular Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of ANN.	9
Module – 5	**No. of Hours**
Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach. Reinforcement Learning: Overview of Reinforcement Learning, Scope of Reinforcement Learning, Reinforcement Learning as Machine Learning, Components of Reinforcement Learning, Markov Decision Process, Multi-Arm Bandit Problem and Reinforcement Problem Types, Model-based Learning, Model Free Methods, Q-Learning, SARSA Learning.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the machine learning techniques, their types and data analysis framework.
CO2	Apply mathematical concepts for feature engineering and perform dimensionality reduction to enhance model performance.
CO3	Develop similarity-based learning models and regression models for solving classification and prediction tasks.
CO4	Build probabilistic learning models and design neural network models using perceptrons and multilayer architectures
CO5	Utilize clustering algorithms to identify patterns in data and implement reinforcement learning techniques

Text Books	
1.	S Sridhar, M Vijayalakshmi, "Machine Learning", OXFORD University Press 2021, First Edition.

Reference Text Books	
1.	Murty, M. N., and V. S. Ananthanarayana. Machine Learning: Theory and Practice, Universities Press, 2024.
2.	T. M. Mitchell, "Machine Learning", McGraw Hill, 1997.
3.	Burkov, Andriy. The hundred-page machine learning book. Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -VI					
Exploratory Data Analysis **Category: PEC II**					
Course Code	:	**B24AI633**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand core exploratory data analysis (EDA) techniques.
2.	To perform data cleaning, transformation, and visualization.
3.	To apply statistical methods to summarize and interpret data.
4.	To identify patterns, relationships, and anomalies in datasets.
5.	To use EDA as a foundation for machine learning model development.

Module – 1	**No. of Hours**
Introduction to Exploratory Data Analysis: Introduction to exploratory data analysis, importance in data science and machine learning, types of data, data collection and data quality, data cleaning techniques, handling missing values, noise removal, outlier detection, introduction to data transformation and normalization.	9
Module - 2	**No. of Hours**
Descriptive Statistics and Data Summarization: Measures of central tendency, including mean, median, and mode, measures of dispersion, such as variance and standard deviation, skewness and kurtosis, summary statistics, data distribution analysis, correlation and covariance, and introduction to statistical interpretation of data.	9
Module – 3	**No. of Hours**
Data Visualization Techniques: Principles of data visualization, Graphical representations: bar charts, histograms, box plots, scatter plots, line plots, Correlation visualization using heatmaps. Visualization libraries: Matplotlib, Seaborn. Interactive visualization tools (Plotly).	9
Module – 4	**No. of Hours**
Multivariate Analysis and Feature Engineering: Bivariate and multivariate data analysis, correlation analysis, feature selection techniques, feature extraction, dimensionality reduction methods including Principal Component Analysis (PCA), handling categorical data, data encoding techniques.	9
Module – 5	**No. of Hours**
Advanced EDA and Applications: Pattern recognition and anomaly detection, handling data imbalance, time-series exploratory analysis, data profiling, automated EDA tools, integration of EDA with machine learning pipelines, and case studies in real-world domains such as healthcare, finance, and business analytics.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the importance and techniques of exploratory data analysis.
CO2	Apply statistical methods to summarize and interpret datasets.
CO3	Develop visualizations to analyze patterns and relationships in data.
CO4	Perform feature engineering and dimensionality reduction.
CO5	Analyze complex datasets and prepare them for machine learning applications.

Text Books	
1.	John W. Tukey, *Exploratory Data Analysis*, Addison-Wesley, 1977.
2.	Catherine M. Marsh and Andrew Gelman, *Data Analysis Using Regression and Multilevel/Hierarchical Models*, Cambridge University Press.

Reference Text Books	
1.	Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly Media, 2017.
2.	Hadley Wickham and Garrett Grolemund, *R for Data Science*, O'Reilly Media, 2017.
3.	Joel Grus, *Data Science from Scratch*, 2nd Edition, O'Reilly Media, 2019.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
Advanced Database Management System **Category: PEC-II**					
Course Code	:	**B24IS634**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Learning Objective is	
1.	To learn strong foundation in advanced database concepts from an industry perspective.
2.	To understand database management system contributes with advanced data modelling concepts like OOD Modelling and ORD Modelling.
3.	To Know advanced database system arranges query processing and transaction management
4.	To study concepts for object-relational database and distributed database.

Module– 1	**No. of Hours**
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Object and Object-Relational Databases: **Overview of Object Database Concepts**: Object Database Extensions to SQL, The ODMG Object Model and the Object Definition Language ODL, Object Database Conceptual Design, The Object Query Language OQL, Overview of the C++ Language Binding in the ODMG Standard.	9
Module– 2	**No. of Hours**
Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures: Introduction, Secondary Storage Devices, Buffering of Blocks, Placing File Records on Disk Operations on Files, Files of Unordered Records (Heap Files), Files of Ordered Records (Sorted Files), Hashing Techniques, Other Primary File Organizations, Parallelizing Disk Access Using RAID Technology, Modern Storage Architectures. **Distributed Database Concepts**: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed	9
Module– 3	**No. of Hours**
NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Systems, The CAP Theorem, Document Based NOSQL Systems and MongoDB, NOSQL Key-Value Stores, Column-Based or Wide Column NOSQL Systems, NOSQL Graph Databases and Neo4j. **Big Data Technologies Based on MapReduce and Hadoop:** What Is Big Data? Introduction to MapReduce and Hadoop, Hadoop Distributed File System (HDFS), MapReduce: Additional Details Hadoop v2 alias YARN, General Discussion.	9
Module– 4	**No. of Hours**
Transaction Management and Concurrency Control:- Transaction: Evaluating Transaction Results, Transaction Properties, Transaction Management with SQL, The Transaction Log – Concurrency Control: Lost Updates, Uncommitted Data, Inconsistent Retrievals, The Scheduler – Concurrency **Control with Locking Methods**: Lock Granularity, Lock Types, Two Phase Locking to Ensure Serializability, Deadlocks – Concurrency Control with Timestamping Methods: Wait/Die and Wait/Wound Schemes – Concurrency Control with Optimistic Methods - Database Recovery Management: Transaction Recovery.	9
Module– 5	**No. of Hours**
Data Storage and Querying:- RAID – File Organization – Organization of Records in Files – Indexing and Hashing: Basic concept, Ordered Indices, B+ tree Index Files: Structure of a B+ Tree (structure only, algorithms not needed) - B tree index files – Static Hashing – Dynamic Hashing – Query Processing: Overview - Selection Operation	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Infer and represent the real-world data using object-oriented database
CO2	Interpret rule set in the database to implement data warehousing of mining
CO3	Discover and design database for recent applications database for better interoperability

CO4	Assess the basic issues of transaction processing and concurrency control.
CO5	Understand the roles that databases play in organizations and familiarize with basic database storage, file organization, database accessing techniques.

Text Books	
1.	Fundamentals of Database Systems, Elmasri and Navathe, Pearson Education2013.
2.	Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 3rd Edition, 2013.
3.	Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw Hill, 6th Edition, 2010

Reference Text Books	
1.	Ashutosh Kumar Dubay, "Database Management Concepts", S.K. Kataria & Sons, 1st Edition (2012).
2.	Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", McGraw Hill, 3rd Edition (2014
3.	Thomas M Connolly and Carolyn E Begg, "Database systems- A Practical Approach to Design, Implementation and Management", Pearson Education, 4th Edition (2014).

Web links and Video lectures (e-Resources)

- https://link.springer.com/book/10.1007/978-3-7091-2704-9
- https://www.youtube.com/watch?v=ywTn9qHyI9I
- https://www.youtube.com/watch?v=_qbKMdqQS6E
- https://www.youtube.com/watch?v=PqPkYmRSQ_w
- https://www.researchgate.net/publication/47393965_Data_warehousing_and_data_mining_A_case_study

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of continuous Internal Evaluation (CIE) is 50% and for the Semester End Examination (SEE) is 50%. The minimum passing mark for the CIE is 40% of maximum marks (20 marks out of 50). The minimum passing mark for SEE is 35% of maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. Student has to secure a minimum 40% (40 marks out of 100) in the total of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping:

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

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Semester –VI					
Introduction to Data Structures **Category: OEC-I**					
Course Code	:	**B24CS641**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce primitive and non-primitive data structures
2.	To understand the various types of data structure along their operations
3.	To study various searching and sorting algorithms
4.	To assess appropriate data structures during program development / problem solving

Module – 1	**No. of Hours**
Arrays: Introduction, One-Dimensional Arrays, Two-Dimensional Arrays, Initializing Two Dimensional Arrays, Multidimensional arrays. **Pointers:** Introduction, Pointer Concepts, Accessing Variables through Pointers, Pointer Applications, Dynamic Memory Allocation Functions. **Structures and Unions:** Introduction, Declaring Structures, Giving Values to Members, Structure Initialization, Comparison of Structure Variables, Arrays of Structures, Arrays within Structures, Nested Structures, Unions, Size of Structures.	9
Module – 2	**No. of Hours**
Stacks: Introduction, Stack Operations, Stack Implementation using Arrays, Applications of Stacks. **Queues:** Introduction, Queue Operations, Queue Implementation using Arrays, Different Types of Queues: Circular Queues, Double-Ended Queues, Priority Queues, Applications of Queues.	9
Module – 3	**No. of Hours**
Linked Lists: Introduction, Singly Linked List, Self-Referential Structures, Operations on Singly Linked Lists: Insert-Delete-Display, Implementation of Stacks and Queues using Linked List, Concatenate two Lists, Reverse a List without Creating a New Node, Static Allocation Vs Linked Allocation. Circular Singly Linked List: Introduction, Operations: Insert-Delete-Display.	9
Module – 4	**No. of Hours**
Trees: Introduction, Basic Concepts, Representation of Binary Trees, Operations on Binary Trees: Insertion-Traversals-Searching-Copying a Tree, Binary Search Trees, Operations on Binary Search Trees: Insertion-Searching-Find Maximum and Minimum Value-Count Nodes, Expression Trees.	9
Module – 5	**No. of Hours**
Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort. Searching: Introduction, Linear Search, Binary Search.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop C programs utilizing fundamental concepts such as arrays, pointers and structures.
CO2	Apply data structures like stacks and queues to solve problems.
CO3	Develop C programs using linked lists and their various types.
CO4	Explain the fundamental concepts of trees and their practical applications.
CO5	Demonstrate different sorting and searching algorithms and determine their algorithmic complexities.

Text Books	
1.	E Balagurusamy, “C Programming and Data Structures”, 4th Edition, McGraw-Hill, 2007.
2.	A M Padma Reddy, “Systematic Approach to Data Structures using C”, 9th Revised Edition, Sri Nandi Publications, 2009.

Reference Text Books	
1.	Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd Edition, Universities Press, 2014.
2.	Seymour Lipschutz, “Data Structures Schaum’s Outlines”, Revised 1st Edition, McGraw-Hill, 2014.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester -VI					
Introduction to Cybersecurity **Category: OEC-I**					
Course Code	:	**B24IC642**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the cybercrime terminologies and perspectives.
2.	To understand Cyber Offenses and Botnets.
3.	To gain knowledge on tools and methods used in cybercrimes.
4.	To understand phishing and computer forensics.

Module - 1	**No. of Hours**
Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws, Global Perspectives.	9
Module - 2	**No. of Hours**
Cyber Offenses: How Criminals Plan Them-Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafé & cybercrimes. **Botnets:** The fuel for cybercrime, Attack Vector.	9
Module - 3	**No. of Hours**
Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spy ways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.	9
Module - 4	**No. of Hours**
Phishing and Identity Theft: Introduction, methods of phishing, phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft.	9
Module - 5	**No. of Hours**
Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understanding the concepts of cybercrime terminologies.
CO2	Understanding the Cyber offenses and Botnets.
CO3	Illustrate Tools and Methods used on Cybercrime.
CO4	Explain Phishing and Identity Theft.
CO5	Justify the need of computer forensics.

Text Books	
1.	Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

Web links and Video lectures (e-Resources)
https://www.youtube.com/watch?v=yC_hFm0BX28&list= PLxApjaSnQGi6Jm7LLSxvmNQjS_rt9swsu https://www.youtube.com/watch?v=nzZkKoREEGo&list= PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI4_ https://www.youtube.com/watch?v=6wi5DI6du-4&list=PL_uaeekrhGzJlB8XQBxU3z_hDwT95xlk https://www.youtube.com/watch?v=KqSqyKwVuA8

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
Fundamentals of Operating Systems **Category: OEC- I**					
Course Code	:	**B24CS643**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1	Explain the need and different types of OS.
2	Discuss suitable techniques for management of different resources.
3	Analyze different memory, storage, and file system management strategies.
4	To understand the concept of deadlocks and analyse the Memory Management Techniques.
5	Understand and familiar with virtual memory management and files.

Module - 1	**No. of Hrs**
Introduction: What operating systems do; Computer System organization; Computer System Organization, Computer System architecture; Operating System operations; Resource Management Operating System Structures: Operating System Services, User and Operating System interface; System calls, Application Program Interface, Types of system calls.	9
Module - 2	**No. of Hrs**
Process Management: Process concept; Process scheduling; Operations on processes; Inter process Communication Multi-threaded Programming: Overview; Multithreading models, Thread Libraries	9
Module - 3	**No. of Hrs**
CPU Scheduling: Basic Concepts, Scheduling criteria, Scheduling algorithms, Thread Scheduling, Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization.	9
Module - 4	**No. of Hrs**
Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Background; Contiguous memory allocation; Paging; Structure of page table.	9
Module - 5	**No. of Hrs**
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; File System Interface: File concept; Access methods; Directory Structure, Protection, File System Implementation: File System Structure, File System Operations, File System Internals: File Systems, File System Mounting; Partition and Mounting, File sharing;	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the fundamentals of operating systems.
CO2	Apply appropriate CPU scheduling algorithm for the given scenarios.
CO3	Analyze the various techniques for process synchronization and deadlock handling.
CO4	Apply the various techniques for memory management.
CO5	Analyze the importance of File System Mounting and File Sharing.

Text Books	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts" II, 10th Edition, John Wiley and Sons Inc., 2018.
2	Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.
Reference Text Books	
1	RamazElmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2	William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3	T V Geetha, "Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives", Pearson, 2024.

Web links and Video lectures (e-Resources)
1. https://archive.nptel.ac.in/courses/106/105/106105214/
2. https://archive.nptel.ac.in/courses/106/102/106102132/

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment-1	50	30 (Average of Best two Assessments)	50
	Internal Assessment-2	50		
	Internal Assessment-3	50		
AAT	Two Assessments as per regulations	20	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and it carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
6. Students should answer five full questions, selecting one full question from each module.
7. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping:

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
AI for Everyone **Category: OEC -1**					
Course Code	:	**B24AI644**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	:	50 Marks
Total Hours	:	45	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand fundamental AI concepts in a non-technical, interdisciplinary context.
2.	To analyze the impact of AI on industries, business processes, and society.
3.	To understand the lifecycle and workflow of AI-driven projects.
4.	To examine ethical, legal, and societal challenges in AI systems.
5.	To identify practical AI applications across diverse domains.

Module –1	**No. of Hours**
Foundations of Artificial Intelligence: Overview of artificial intelligence, historical evolution, types of AI, including narrow and general AI, key concepts such as machine learning, deep learning, and data science, comparison between AI-driven systems and traditional programming, and broad applications of AI across industries.	9
Module –2	**No. of Hours**
AI in Business and Industry: Role of AI in digital transformation, applications in healthcare, finance, retail, manufacturing, and smart services, automation and workforce transformation, AI-enabled decision-making, introduction to data-driven organizations, and case studies illustrating successful AI adoption.	9
Module –3	**No. of Hours**
AI Project Lifecycle and Workflow: Problem identification and formulation for AI solutions, data collection and labeling, data preparation and feature understanding, model selection and evaluation, deployment considerations, interaction between technical and non-technical stakeholders, and an overview of commonly used AI tools and platforms.	9
Module –4	**No. of Hours**
Ethics, Bias, and Governance in AI: Ethical principles in AI, sources of bias in datasets and models, fairness and accountability, transparency and explainability, privacy and data protection, regulatory considerations, responsible AI development, and governance frameworks.	9
Module –5	**No. of Hours**
AI Applications and Future Trends: Applications of AI in natural language processing, computer vision, robotics, and recommendation systems. Introduction to generative AI, AI for sustainability and smart systems, emerging trends in AI, challenges, risks, and opportunities in widespread AI adoption.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain fundamental concepts and types of artificial intelligence.
CO2	Analyze the impact of AI on business processes and societal transformation.
CO3	Understand and describe the workflow of AI projects and data-driven problem solving
CO4	Evaluate ethical, legal, and social implications of AI technologies.
CO5	Identify and assess opportunities for applying AI in real-world scenarios.

Text Books	
1.	Andrew Ng, *AI for Everyone*, DeepLearning.AI, 2019.
2.	Ajay Agrawal, Joshua Gans, and Avi Goldfarb, *Prediction Machines: The Simple Economics of Artificial Intelligence*, Harvard Business Review Press, 2018.

Reference Text Books	
1.	Melanie Mitchell, *Artificial Intelligence: A Guide for Thinking Humans*, Farrar, Straus and Giroux, 2019.
2.	Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2020.
3.	Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order*, Houghton Mifflin Harcourt, 2018.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. The question paper will have two parts: Part-A and Part-B.
3. **Part-A** should contain minimum **Two or Four** quiz questions from each module of 02 marks/ 01 marks each. **Part-A is Compulsory** and carries 20 Marks.
4. **Part-B** contains total 10 questions.
5. Two questions of 16 marks (with minimum of 3 sub questions) from each module with internal choice.
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CO2	2	3	2	2	2	2	1	1	2	1	1
CO3	2	3	3	2	2	-	1	1	2	1	1
CO4	1	3	2	3	3	2	2	1	2	1	2
CO5	1	2	2	2	3	2	3	1	2	1	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-VI					
Full Stack Development using Java Lab **Category: PCCL**					
Course Code	:	**B24IS605L**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the fundamentals of full stack development and web application architectures.
2.	To develop skills in designing responsive and interactive front-end interfaces using modern web technologies.
3.	To provide knowledge of server-side development using Java-based frameworks and technologies.
4.	To understand database concepts and integrate backend applications with databases.
5.	To familiarize students with full stack integration, deployment practices, and basic security concepts.

Sl. No.	**List of the experiment**
1.	Design a static web page using **HTML5** to display student or employee details with proper formatting.
2.	Create a responsive web page using **CSS3** with Flexbox to demonstrate layout alignment.
3.	Develop a **JavaScript** program to perform client-side form validation using DOM manipulation.
4.	Write a **Java Servlet** program to handle HTTP GET and POST requests.
5.	Create a **JSP** application to display dynamic content using scriptlet and expression tags.
6.	Implement an **MVC-based Java web application** using Servlets and JSP.
7.	Develop a **JDBC** program to perform CRUD operations on a database.
8.	Create a **Spring Boot** application to expose RESTful web services.
9.	Integrate **Spring Boot** with a database using **Hibernate/JPA**.
10.	Develop a **mini full stack application** integrating frontend, backend, and database with basic authentication.
11.	Develop a web application to demonstrate **session management** using Java Servlets or JSP.
12.	Create and deploy a **full stack Java application** on a local server demonstrating frontend–backend integration and database connectivity.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the fundamentals of full stack development, client–server architecture, and web application architectures.
CO2	Design responsive and interactive user interfaces using HTML, CSS, and JavaScript.
CO3	Develop server-side applications using Java technologies such as Servlets, JSP, and Spring Boot.
CO4	Implement database operations and integrate backend applications using SQL, JDBC, and ORM frameworks.
CO5	Integrate frontend and backend components, deploy full stack applications, and address basic security challenges.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**20**	**50**
	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

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

Level 3 – High, Level 2 – Moderate, Level 1 –Low

Semester-VI					
Explainable AI **Category: AEC-VI**					
Course Code	:	**B24AI681**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the concepts and importance of Explainable Artificial Intelligence (XAI).
2.	To apply interpretability techniques to machine learning and deep learning models.
3.	To analyze model predictions using explainability tools and visualization techniques.
4.	To evaluate fairness, transparency, and bias in AI systems.
5.	To develop practical skills to build interpretable AI models for real-world applications.

Sl. No.	**Title of the program/list of the experiment**
1.	Installation and setup of Explainable AI tools and libraries; introduction to datasets and preprocessing techniques.
2.	Development of a basic machine learning classification model and evaluation of model performance.
3.	Implementation of feature importance analysis for machine learning models
4.	Global model interpretation using visualization techniques
5.	Local explanation of model predictions using the LIME technique
6.	Model interpretation using SHAP values.
7.	Visualization of feature contributions using SHAP plots
8.	Evaluation of model bias and fairness in machine learning systems.
9.	Interpretation of deep learning models using visualization methods such as saliency maps or Grad-CAM.
10	Comparative Study of XAI Techniques: Compare LIME, SHAP, and feature importance methods.
11.	**Mini project:** Development of an explainable AI model using a real-world dataset and presentation of interpretation results.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the importance of explainability in artificial intelligence systems.
CO2	Apply interpretability techniques to analyze machine learning models.
CO3	Interpret model predictions using visualization and explanation tools.
CO4	Evaluate bias, fairness and transparency in AI models.
CO5	Develop explainable AI solutions for practical applications.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

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CONTINUOUS INTERNAL EVALUATION (CIE)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
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	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hour.

CO-PO Mapping

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

Level 3 – High, Level 2 – Moderate, Level 1 -Low

Semester-VI					
Generative AI **Category: AEC**					
Course Code	:	**B24AI682**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the principles and concepts behind generative AI models
2.	To explain the knowledge gained to implement generative models using Prompt design frameworks.
3.	To apply various Generative AI applications for increasing productivity.
4.	To develop Large Language Model-based Apps.

Sl. No.	**Title of the program / list of the experiment**
1.	Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyze results.
2.	Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships. Generate contextually rich outputs using embeddings. Write a program to generate 5 semantically similar words for a given input.
3.	Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics.
4.	Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.
5.	Use word embeddings to create meaningful sentences for creative tasks. Retrieve similar words for a seed word. Create a sentence or story using these words as a starting point. Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words.
6.	Use a pre-trained Hugging Face model to analyze sentiment in text. Assume a real-world application, Load the sentiment analysis pipeline. Analyze the sentiment by giving sentences to input.
7.	Summarize long texts using a pre-trained summarization model using Hugging face model. Load the summarization pipeline. Take a passage as input and obtain the summarized text.
8.	Install langchain, cohere (for key), langchain-community. Get the api key(By logging into Cohere and obtaining the cohere key). Load a text document from your google drive . Create a prompt template to display the output in a particular manner.
9.	Take the Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: The founder of the Institution. When it was founded. The current branches in the institution . How many employees are working in it. A brief 4-line summary of the institution.
10.	Build a chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop the ability to explore and analyze word embeddings, perform vector arithmetic to investigate word relationships, visualize embeddings using dimensionality reduction techniques
CO2	Apply prompt engineering skills to real-world scenarios, such as information retrieval, text generation.
CO3	Utilize pre-trained Hugging Face models for real-world applications, including sentiment analysis and text summarization.
CO4	Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
2. All laboratory experiments are to be included for practical examination.
3. Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
4. Rubrics suggested for SEE, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks.
5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO2	3	3	3	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	2	2	-	-
CO4	3	3	3	-	-	-	-	2	2	-	-

Level 3 – High, Level 2 – Moderate, Level 1 -Low

Semester-VI					
Software Testing Automation **Category: AEC-VI**					
Course Code	:	**B24IS683**	CIE	:	50 Marks
Teaching Hours L:T:P :S	:	0:0:2:0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To introduce the features, components and benefits of the Katalon and Selenium Studio.
2.	To understand the Test Case Design, Test Execution and Test Data Management.
3.	To understand the Concept of Test Automation
4.	To understand the Test Scenario Development

Sl. No.	**List of Experiments**
1.	**Installation of Katalon Studio:** Installation and Setup, Web Locators & Techniques, Selectors Huband browsers devtools Installation of Katalon Studio: Installation and Setup, Web Locators &Techniques, Selectors Huband browsers devtools.
2.	**Automation Modes in Katalon Studio:** Katalon Studio record mode, Katalon Studio manualmode, Katalon Studio keywords and Katalon Studio script mode.
3.	**Exploring Katalon Recorder Tool:** Recorder Tool Chrome Browser, Firefox, Explorer, Play test cases in Recorder
4.	**Exploring Web Spy & Web Object Repository:** Web Spy & Object Repository, Spy on web object in a browser, Object locators and strategies.
5.	**Exploring the Predefined pre –Defined Web UI Keywords:** browser Keywords, windows Keywords, checkbox Keywords, combo box, file upload, screenshot, scroll down and scroll up button related, alerts frames, mouse hover, drag, and drop and keystroke Keywords.
6.	**Installation of Selenium:** Setting up Selenium RC & Selenium Web Driver.
7.	**Designing Test cases:** Test Case design and Conversion of Mapping and Templates using Selenium tool and manual test cases mapping with Selenium test cases.
8.	**Using Selenium IDE:** Develop a test suite containing minimum 4 test cases.
9.	**Test Suite:** Conduct a test suite for any two website.
10.	**Test Scripts:** Develop and test a program to login a specific web page using Selenium test scripts.
11.	**Test Scripts:** Develop and test a program to provide total number of objects present available on the page using Selenium test scripts.
12.	**Practical Exercise and Wrap-Up:** Build Test suite with suitable applications and complete end-to-end automation process.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate Katalon studio and Selenium Architecture and key features of Katalon studio and Selenium Automation Tool.
CO2	Develop test scenarios that can be run automatically.
CO3	Develop test cases and modules in automation tool.
CO4	Develop selenium to build test cases and run test cases in different browsers.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**20**	**50**
	Laboratory Test -1	**50**	**15**	
	Laboratory Test -2	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
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5. Change of experiment is allowed only once and 15% of Marks allotted to the Conduction procedure part are to be made zero. The minimum duration of SEE is 03 hours.

CO-PO Mapping

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

Level3 -High, Level2- Moderate, Level1 - Low

Semester-VI					
REACT **Category: AEC- VI**					
Course Code	:	**B24CS684**	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	0 : 0 : 2 : 0	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To enable students to develop React applications utilizing functional and class-based components, effectivelymanaging state with hooks and lifecycle methods .
2.	To introduce, how to pass data dynamically between parent and child components using props, ensuring modularand reusable component design.
3.	To create dynamic and responsive applications, integrating forms, validation, task management systems, and styledcomponents.
4.	To use React Router for navigation, external API integration for dynamic data handling, and CSS styling techniquesfor modern UI/UX design.

Sl. No	**List of Experiments**
1	Use create-react-app to set up a new project. Edit the App.js file to include a stateful component with useState.Add an input field and a <h1> element that displays text based on the input. Dynamically update the <h1> contentas the user types.
2	Develop a React application that demonstrates the use of props to pass data from a parent component to childcomponents. The application should include the parent component named App that serves as the central containerfor the application. Create two separate child components, Header: Displays the application title or heading. Footer:Displays additional information, such as copyright details or a tagline. Pass data (e.g., title, tagline, or copyrightinformation) from the App component to the Header and Footer components using props. Ensure that the contentdisplayed in the Header and Footer components is dynamically updated based on the data received from the parentcomponent.
3	Create a Counter Application using React that demonstrates state management with the useState hook. Display thecurrent value of the counter prominently on the screen. Add buttons to increase and decrease the counter value.Ensure the counter updates dynamically when the buttons are clicked. Use the useState hook to manage thecounter's state within the component. Prevent the counter from going below a specified minimum value (e.g., 0).Add a "Reset" button to set the counter back to its initial value. Include functionality to specify a custom incrementor decrement step value.
4	Develop a To-Do List Application using React functional components that demonstrates the use of the useStatehook for state management. Create a functional component named ToDoFunction to manage and display the to-do list. Maintain a list of tasks using state. Provide an input field for users to add new tasks. Dynamically renderthe list of tasks below the input field. Ensure each task is displayed in a user-friendly manner. Allow users todelete tasks from the list. Mark tasks as completed or pending, and visually differentiate them.
5	Develop a React application that demonstrates component composition and the use of props to pass data. Createtwo components: FigureList: A parent component responsible for rendering multiple child components.BasicFigure: A child component designed to display an image and its associated caption. Use the FigureListcomponent to dynamically render multiple BasicFigure components. Pass image URLs and captions as props fromthe FigureList component to each BasicFigure component. Style the BasicFigure components to display the imageand caption in an aesthetically pleasing manner. Arrange the BasicFigure components within the FigureList in agrid or list format. Allow users to add or remove images dynamically. Add hover effects or animations to theimages for an interactive experience.
6	Design and implement a React Form that collects user input for name, email, and password. Form Fields areName, Email, Password. Ensure all fields are filled before allowing form submission.Validate the email field to ensure it follows the correct email format (e.g., example@domain.com). Optionally enforce a minimum passwordlength or complexity. Display error messages for invalid or missing inputs. Provide visual cues (e.g., red borders)to highlight invalid fields. Prevent form submission until all fields pass validation. Log or display the entered dataupon successful submission (optional). Add a "Show Password" toggle for the password field. Implement client-side sanitization to ensure clean input.
7	Develop a React Application featuring a ProfileCard component to display a user's profile information,

	includingtheir name, profile picture, and bio. The component should demonstrate flexibility by utilizing both external CSSand inline styling for its design. Display the following information: Profile picture, User's name, A short bio ordescription Use an external CSS file for overall structure and primary styles, such as layout, colors, and typography.Apply inline styles for dynamic or specific styling elements, such as background colors or alignment. Design theProfileCard to be visually appealing and responsive. Ensure the profile picture is displayed as a circle, and thename and bio are appropriately styled. Add hover effects or animations to enhance interactivity. Allow thebackground color of the card to change dynamically based on a prop or state.
8	Develop a Reminder Application that allows users to efficiently manage their tasks. The application should includethe following functionalities: Provide a form where users can add tasks along with due dates. The form includestask name,Due date,An optional description. Display a list of tasks dynamically as they are added. Show relevantdetails like task name, due date, and completion status. Include a filter option to allow users to view all Tasks andDisplay all tasks regardless of status. Show only tasks marked as completed. Show only tasks that are not yetcompleted.
9	Design a React application that demonstrates the implementation of routing using the react-router-domlibrary. The application should include the Navigation Menu: Create a navigation bar with links to threedistinct pages, Home, About, Contact. Develop separate components for each page (Home, About, andContact) with appropriate content to differentiate them. Configure routes using react-router-dom to renderthe corresponding page component based on the selected link. Use BrowserRouter and Route componentsfor routing. Highlight the active link in the navigation menu to indicate the current page
10	Design and develop a React application using a class-based component to demonstrate the use of lifecycle methods with external API integration. The application should fetch data from a public REST API and display it in a structured table or card format. Use the componentDidMount() method to retrieve initial data when the component is first rendered. Implement search, filter, and refresh options for user interaction. Use the componentDidUpdate() method to detect changes in state or props and trigger updated API requests accordingly. Include proper error handling for network failures and empty responses, and display appropriate messages to the user. Ensure that all updates are reflected dynamically without reloading the page.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Illustrate React fundamentals including components and state management.
CO2	Develop React applications using component composition and data passing through props.
CO3	Apply dynamic state updates, event handling, and custom logic for incrementing, decrementing, and resetting values.
CO4	Implement React forms to collect, validate, and manage user input.
CO5	Demonstrate interaction with external APIs for dynamic content generation and real-time state management.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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CONTINUOUS INTERNAL EVALUATION (CIE)

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	Laboratory Test -1	50	15	
	Laboratory Test -2	50	15	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

1. SEE marks for the practical course are 50 Marks. Practical examinations are to be conducted between the schedules mentioned in the academic calendar of the Institution.
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CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 - Low

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Common Courses

V & VI Semester

UG – B.E (2024 Scheme)

INDEX

Semester-V					
Biology for Engineers **Category: BSC** **(Common to All)**					
Course Code	:	**B24BEK507**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	2:0:0:2	SEE	:	50 Marks
Total Hours	:	30	Total	:	100 Marks
Credits	:	2	SEE Duration	:	2 Hrs

Course Learning Objective is	
1.	To familiarize the students with the basic biological concepts and their engineering applications.
2.	To enable the students with an understanding of biodesign principles to create novel devices and structures.
3.	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4.	To motivate the students to develop interdisciplinary vision of biological engineering.

Module– 1	**No. of Hours**
Introduction to Biology: The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. **Biomolecules:** Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.	6
Module– 2	**No. of Hours**
Application of Biomolecules: Carbohydrates in cellulose-based water filters production, PHA and PLA in bio plastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production.	6
Module– 3	**No. of Hours**
Adaptation of Anatomical Principles for Bioengineering Design: Brain as a CPU system. Robotic arms for prosthetics. Engineering solutions for Parkinson's disease. Eye as a Camera system, bionic eye. Heart as a pump system, pace makers, defibrillators. Lungs as purification system, Heart-lung machine. Kidney as a filtration system, dialysis systems.	6
Module– 4	**No. of Hours**
Nature-Bioinspired Materials and Mechanisms: Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Shark skin, Kingfisher beak. Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	6
Module– 5	**No. of Hours**
Trends in Bioengineering: DNA origami and Biocomputing, Bioprinting techniques and materials. Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Biomining.	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	Corroborate the concepts of biomimetics for specific requirements.
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.

Text Books	
1.	Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2.	Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022

Web links and Video Lectures (E-Resources)
• https://nptel.ac.in/courses/121106008 • https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009

• https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006 • https://www.coursera.org/courses?query=biology	
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1.	Group Discussion of Case studies.
2.	Model Making and seminar/poster presentations.
3.	Design of novel device/equipment like Cellulose-based water filters, Filtration system.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**30**	**50**
	Internal Assessment2	**50**	**(Average of Best two**	
	Internal Assessment3	**50**	**Assessments)**	
AAT	**Any Two Assessments as per Regulations**	**20**	**20**	
SEE	**Semester End Examination**	**50**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper shall be set for 50 marks and duration of SEE is 2 Hours.
2. Two questions of 10 marks (with minimum two sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Mention COs, POs, Bloom's Taxonomy levels in the question paper.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO8	PO11
CO1	1	-	-	-	-	1	1	-	1	1	1
CO2	1	-	-	-	-	1	-	1	-	1	1
CO3	1	-	-	-	-	1	-	1	-	1	1
CO4	1	-	-	-	-	1	2	-	2	1	1
CO5	1	-	-	-	-	1	2	2	1	2	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Environmental Science and E-Waste Management **Category: NCMC** **(Common to All)**					
Course Code	:	**B24ESK510**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	2:0:0:0	SEE	:	-
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	-

Course Learning Objective is	
1.	To identify the major challenges of environment issues.
2.	To develop skills, critical thinking and demonstrate socio-economic skills for Environmental protection.
3.	To analyze the impact of issues w. r. t. waste management.

Module– 1	**No. of Hours**
Ecosystem and Sustainability: Ecosystems: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. **Sustainability:** 17SDG targets and possible actions.	6
Module– 2	**No. of Hours**
Natural Resources and Energy: Natural Resources: Water resources-Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water. **Energy:** Different types of energy, Conventional sources & Non-Conventional sources of energy, solar energy. Wind energy, Hydrogen as an alternative energy.	6
Module– 3	**No. of Hours**
Environmental Pollution: Water Pollution, Noise pollution, Air pollution (Sources, Impacts, Preventive measures and public Health Aspects. **Global Environmental Concerns (Concept, policies and case-studies):** Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	6
Module– 4	**No. of Hours**
Waste management: Solid Waste Management, types and sources, functional elements of SWM, Biomedical Waste Management-Sources, Characteristics. **Environmental Legislation:** Solid Waste Management Rules, 2016, Biomedical Waste Management Rules, 2016.	6
Module– 5	**No. of Hours**
E-Waste Management: E-waste; composition and generation. Global context in e-waste; E-Waste pollutants, E-waste hazardous properties, Effects of pollutant (E-waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E Waste management. E-waste (Management and Handling) Rules, 2011; and E-waste (Management) Rules, 2022-Salient Features and its implications.	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	Comprehend the principles of ecology and environmental issues pertaining to air, land and water on a global scale.
CO2	Acquire observation skills for solving problems related to the environment.
CO3	Conduct survey to describe the realities of waste management system.

Text Books	
1.	S M Prakash, "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore, 2018.
2.	Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Text Books	
1.	Benny Joseph (2005), "Environmental Studies" , Tata McGraw – Hill Publishing Company Limited.
2.	Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.

Web links and Video Lectures (e-Resources):	
1.	https://www.youtube.com/playlist?list=PLXTQoJ3yDR1Tp9O8R7RZGmm_GdheHqM2w
3.	https://sdgs.un.org/goals
4.	https://kspcb.karnataka.gov.in/waste-management/biomedical-waste
5.	E Waste (Management) Rules, 2022: https://kspcb.karnataka.gov.in/sites/default/files/inlinefiles/ E%20Waste%20%28Management%29%20Rules%2C%202022.pdf

ASSESSMENT DETAILS (CIE only)

The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks (40 marks out of 100).

CONTINUOUS INTERNAL EVALUATION (MCQs)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**50 (Average of Best two Assessments)**	**100**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per Regulations**	**50**	**50**	
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	0	0	0	0	3	2	0	0	0	0
CO2	0	0	0	0	0	1	1	0	0	0	1
CO3	0	0	0	0	0	2	2	0	0	0	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-V					
Research Methodology & IPR (RMIPR) **Category: AEC**					
Course Code	:	**B24RMK606**	CIE	:	50 Marks
Teaching Hours L:T: P : S	:	1 : 0 : 0 : 3	SEE	:	50 Marks
Total Hours/Semester	:	15	Total	:	100 Marks
Credits	:	1	SEE Duration	:	1 Hours

Course Learning Objective is	
1.	To understand the fundamentals of research, types of research methodologies, and ethical practices involved in engineering research.
2.	To develop the ability to conduct effective literature review, technical reading, and identify research gaps for problem formulation.
3.	To design research methodologies, apply appropriate sampling techniques, and perform data collection and hypothesis testing.
4.	To analyze, interpret, and present research findings through structured technical reports and research papers using standard tools and formats.
5.	To understand Intellectual Property Rights (IPR), patenting processes, and their role in innovation, society, and sustainable development.

Module – 1	**No. of Hours**
Introduction to Research & Research Methodology: Meaning, Objectives of Engg. Research & Characteristics of good research, Research Methods v/s Research Methodology, Types of engineering research, Descriptive v/s Analytical, Applied v/s Fundamental, Quantitative v/s Qualitative, Conceptual v/s Empirical, Research, Criteria of good research, Developing a research plan, Ethics & plagiarism in Engineering Research with Research Practice for different types of Research Misconducts, Case Study and Practice Sessions	3
Module – 2	**No. of Hours**
Literature Review and Technical Reading: What is literature review or survey, New & Existing Knowledge, Bibliographic Databases, Search Engines, Google & Google Scholar, Effective Search, Conceptualizing Research Reviews, Gaps in research, Critical and Creative Reading, Taking Notes While Reading, Defining research problems, Datasheets, Importance of literature review in defining a problem, Primary and secondary sources of info - Review articles, treatise, monographs, papers from conferences & journals, case-studies, reports, patents, web and net searching ; Identifying gap areas from literature review, Citations, Acknowledgments, Case Studies and Practice sessions.	3
Module – 3	**No. of Hours**
Research Design and Methods: Research design, Basic Principles, Need for research design, Features of good design, Development of Models, Developing a research plan, Exploration, Description, Diagnosis, Simulation and Experimentations, Determining experimental and sample designs, Sampling design, Steps in sampling design, Characteristics of a good sample design, Types of sample designs, Measurement and scaling techniques, Methods of data collection, Collection of primary & secondary data, Data collection instruments, Hypothesis - Basic Concepts, Testing of hypotheses, flow diagram for hypotheses testing, Case Study and Practice Sessions.	3
Module – 4	**No. of Hours**
Technical Report & Paper Writing: Interpretation and report writing, Techniques of interpretations, Structure and components of scientific reports, Different steps in the report preparation – Layout, organization, structure and language of the report, Illustrations and tables with result analysis (simulation or experimentation), Types of reports, technical reports, project reports (mini & major) and research thesis, Research tools for writing, Conclusions, Future works, Flow of a research article, Research paper writing for conference & journals, text-books, Case Study and Practice Sessions.	3
Module – 5	**No. of Hours**
IPRs & Copyrights: Intellectual Property, what are patents & copyrights in IP? Role of IP in the Economic and Cultural Development of the Society, IP Governance, Invention and Creativity, Importance and Protection of Intellectual Property Rights (IPRs), A brief summary of - Patents, Monographs, Copyrights ©, Registered Firms ®, Trademarks ™, Industrial Designs (Design Patent,	3

Utility Patent, Granted Patent, Commercialized Patent) – Indian &Foreign Patents, Steps in Patenting — Application and Procedures with Searches, Case Study and Practice Sessions.	

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain research fundamentals, methodologies, and ethical practices in engineering research.
CO2	Perform literature review, identify research gaps, and formulate research problems.
CO3	Design research experiments, collect data, and apply hypothesis testing methods.
CO4	Analyze results and prepare technical reports and research papers.
CO5	Apply IPR concepts including patents, copyrights, and trademarks in research and innovation.

Research Papers & Technical References (Web-links & Video Resources)

- IEEE Xplore – https://ieeexplore.ieee.org
- Scopus – https://www.scopus.com
- Science Direct – https://www.sciencedirect.com
- Google Scholar – https://scholar.google.com
- Research Gate – https://www.researchgate.net

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CONTINUOUS INTERNAL EVALUATION (MCQs)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment-1	50	30 (Average of Best two Assessments)	50
	Internal Assessment-2	50		
	Internal Assessment-3	50		
AAT	Two Assessments as per regulations	20	20	
SEE	Semester End Examination	50		50
Total Marks				100

SEMESTER END EXAMINATION (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

CO-PO Mapping

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

L = Low (**1**), M = Medium (**2**), H = High (**3**) - Blank = No significant mapping correlation levels

Semester - VI					
Capstone Project Work: Phase - I **Category: SDC**					
Course Code	:	**B24PRJ607**	CIE	:	100 Marks
Teaching Hours L:T:P:S	:	0:0:4:0	SEE	:	-
Total Hours	:	60	Total	:	100 Marks
Credits	:	2	SEE Duration	:	-

Capstone Project: Phase -I and Phase - II

The Capstone project is a comprehensive, year-long project carried out in two phases during **6th and 7th** semesters of the undergraduate program. It integrates knowledge and skills acquired from multiple courses and disciplines to address a complex, real-world problem.

This project provides students with an opportunity to apply scientific principles, engineering methodologies, and technological tools to conceive, design, implement and evaluate an engineering solution.

It serves as a culminating academic experience to demonstrate program outcomes, including problem-solving ability, teamwork, communication skills, and practical application of engineering principles. Students can take up project individually or in a group not exceeding 4 students. The group may have students from the same discipline and drawn from different disciplines.

Types of Capstone Projects: Capstone projects undertaken for one year may fall into one or more of the following categories:

a) Research-Oriented Projects :
   • Focus on investigating new concepts, theories, or technologies.
   • Aim to generate new knowledge or contribute to academic research.

b) Experimental/Analytical Projects
   • Based on laboratory or field experiments to validate a hypothesis or study a phenomenon.
   Simulation/ Modelling Projects
   • Including detailed data collection, analysis, and interpretation.
   • Use computational tools to model, simulate, and predict system behavior.
   • Reduce the need for physical prototyping in the initial stages.

c) Industrial/Industry-Sponsored Projects
   • Carried out in collaboration with an industry partner.
   • Address real-world engineering problems faced by the organization.

d) Interdisciplinary/Multidisciplinary Projects
   • Combine knowledge and techniques from multiple engineering domains or other fields such as management, medicine, or environmental sciences.

e) Entrepreneurial/Innovation Projects
   • Focus on product or service innovation with potential for commercialization.

- Phase I Evaluation: Capstone Project Phase-I shall have only Continuous Internal Evaluation (CIE).
- In case disciplinary capstone project, the CIE shall be conducted by the Departmental Project Review Committee, which consists of a Senior Professor, the Project Guide, and one additional faculty member appointed by the principal for projects within the parent discipline.
- For Interdisciplinary Projects, the Project Review Committee will consist of one Senior Professor, the department and interdepartmental Project Guides and one faculty member from a department related to the interdisciplinary project. The committee members are appointed by the principal of the college.
- Phase I evaluation shall be based on rubrics designed to measure graduate attributes defined by NBA. Successful completion of Phase-I allows the student to proceed to Phase-II.
- Phase II Evaluation: CIE of Phase shall be evaluated as indicated with phase -I evaluation. The SEE shall be conducted by two examiners. The assessment shall be based on rubrics designed to measure graduate attributes.

Review #	**Agenda**	**Assessment**	**Review Assessment Weightage**
Review1	Project Synopsis / Proposal Evaluation	Rubric R1	15
Review2	Mid-Term Project Evaluation	Rubric R2	30
Review3	End Semester Project Evaluation	Rubric R3	30
Review4	Project Report Evaluation	Rubric R4	15
Review5	Evaluation by Guide	Rubric R5	10
Continuous Internal Evaluation (CIE)			100
Total Marks			100

Rubric #R1: Project Synopsis / Proposal Evaluation Maximum Marks: 15

		Excellent (5 Marks)	Good (4 Marks)	Average (3 Marks)	Acceptable (2 Marks)	Unacceptable (1 Marks)
a	**Identification of Problem Domain and Detailed Analysis**	Detailed and extensive explanation of the purpose and need of the project	Good explanation of the purpose and need of the project	Average explanation of the purpose and need of the project	Moderate explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
b	**Study of the Existing Systems and Feasibility of Project Proposal**	Detailed and extensive explanation of the specifications and the limitations of the existing systems	Collects a great deal of information and good study of the existing systems	Moderate study of the existing systems; collects some basic information	Explanation of the specifications and the limitations of the existing systems not very satisfactory; limited information	Minimal explanation of the specifications and the limitations of the existing systems; incomplete information
c	**Objectives and Methodology of the Proposed Work**	All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified	Good justification to the objectives; Methodology to be followed is specified but detailing is not done	Incomplete justification to the objectives proposed; Steps are mentioned but unclear; without justification to objectives	Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not specified properly	Objectives of the proposed work are either not identified or not well defined; Incomplete and improper specification

Rubric #R2: Mid-term Project Evaluation Maximum Marks: 30

		Level of Achievement				
		Excellent(10)	**Good (8)**	**Average(6)**	**Acceptable(4)**	**Unacceptable (2)**
a	**Design Methodology**	• Division of problem in to modules and good selection of computing framework. • Appropriate design methodology and properly justification.	• Division of problem into modules and good selection of computing frame work. • Design methodology not properly justified.	• Division of problem into modules but in appropriate selection of computing framework. • Design methodology not defined properly.	• Partial division of problem into modules and inappropriate selection of computing framework. • Design methodology not defined properly.	• Modular approach not adopted. • Design methodology not defined.
b	**Planning of Project Work and Team Structure**	• Time frame properly specified and being followed. • Appropriate distribution of project work.	• Time frame properly specified and being followed. • Distribution of project work inappropriate.	• Time frame properly specified, but not being followed. • Distribution of project work un-even.	• Time frame properly specified, but not being followed. • Un-even distribution of Project work and no synchronization.	• Time frame not properly specified. • In-appropriate distribution of project work.

c	**Demonstration and Presentation**	• Objectives achieved as per time frame. • Contents of presentations are appropriate and well arranged. • Proper eye contact with audience and clear voice with good spoken language.	• Objectives achieved as per time frame • Contents of presentations are appropriate but not well arranged Satisfactory demonstration, clear voice with good spoken language but eye contact not proper	• Objectives achieved as per time frame. • Contents of presentations are appropriate but not well arranged. • Presentation not satisfactory and average demonstration	• Objectives not achieved as per time frame. • Contents of presentations are not appropriate. • Eye contact with few people and unclear voice.	• No objectives achieved. • Contents of Presentations are not appropriate and not well delivered. • Poor delivery of presentation.

Rubric #R3: End Semester Internal Project Evaluation Maximum Marks: 30

		Excellent(10)	Good (8)	Average(6)	Acceptable(4)	Unacceptable (2)
a	**Incorporation of Suggestions**	Changes are made as per modifications suggested during midterm evaluation and new innovations added	Changes are made as per modifications suggested during mid-term evaluation and good justification	All major changes are made as per modifications suggested during midterm evaluation	Few changes are made as per modifications suggested during midterm evaluation	Suggestions during mid-term evaluation are not incorporated
b	**Project Demonstration**	• All defined objectives are achieved. • Each module working well and properly demonstrated. • All modules of project are well integrated and system working is accurate.	• All defined objectives are achieved. • Each module working well and properly demonstrated. • Integration of all modules not done and system working is not very satisfactory.	• All defined objectives are achieved. • Modules are working well in isolation and properly demonstrated. • Modules of project are not properly integrated.	• Some of the defined objectives are achieved. • Modules are working well in isolation and properly demonstrated • Modules of project are not properly integrated.	• Defined objectives are not achieved. • Modules are not in proper working form that further leads to failure of integrated system.
c	**Presentation**	• Contents of presentations are appropriate and well delivered. • Proper eye contact with audience and clear voice with good spoken language	• Contents of presentations are appropriate and well delivered. • Clear voice with good spoken language but less eye contact with audience	• Contents of presentations are appropriate but not well delivered . • Eye contact with few people and unclear voice	• Contents of presentations are not appropriate. • Eye contact with few people and unclear voice	• Contents of presentations are not appropriate and not well delivered . • Poor delivery of presentation

Rubric #R4: Project Report Evaluation Maximum Marks: 15

Level of Achievement						
		Excellent(5)	**Good (4)**	**Average(3)**	**Acceptable(2)**	**Unacceptable (1)**
a	**Project Report**	• Project report is according to the specified format. • References and citations are appropriate and well mentioned.	• Project report is according to the specified format. • References and citations are appropriate but not mentioned well.	• Project report is according to the specified format but some mistakes. • In-sufficient references and citations.	• Project report is not fully according to the specified format. • In-sufficient references and citations	• Project report not prepared according to the specified format. • References and citations are not appropriate
b	**Description of Concepts and Technical Details**	• Complete explanation of the key concepts. • Strong description of the technical requirements of the project.	• Complete explanation of the key concepts. • In-sufficient description of the technical requirements of the project.	• Complete explanation of the key concepts but little relevance to literature. • In-sufficient description of the technical requirements of the project.	• All key concepts are not explained and very little relevant to literature. • In-sufficient description of the technical requirements of the Project.	• Inappropriate explanation of the key concepts. • Poor description of the technical requirements of the project.
c	**Conclusion and Discussion**	• Results are presented in very appropriate manner • Project work is well summarized and concluded. • Future extensions in the project are well specified.	• Results are presented in good manner. • Project work summary and conclusion not very appropriate. • Future extensions in the project are specified.	• Results presented are not much Satisfactory. • Project work summary and conclusion not very appropriate. • Future extensions in the project are specified.	• Results presented are not much satisfactory. • Project work summary and conclusion not very appropriate. • Future extensions in the project are not specified.	• Results are not presented properly. • Project work is not summarized and concluded. • Future extensions in the project are not specified.

Rubric #R5: Evaluation by Guide Maximum Marks: 10

Level of Achievement				
		Excellent (5)	**Satisfactory(3)**	**Unsatisfactory(2)**
a	**Self-Motivation, Determination and Regularity**	• Approaches the project with self-motivation and follows it through to completion. • Reports to the guide regularly and consistent in work.	• Completes the project but sometimes lacks self-motivation. • Reports to the guide but lacks consistency	• Lacks self-motivation and determination. • Irregular in attendance and in consistent in work.
b	**Working with in a Team & Technical Knowledge and Awareness related to the Project**	• Collaborates and communicates in a group situation and integrates the views of others. • Extensive knowledge related to the project.	• Exchanges some views but requires guidance to collaborate with others. • Fair knowledge related to the project	• Makes little or no attempt to collaborate in a group situation. • Lack sufficient knowledge.

Semester-VI					
Indian Knowledge Systems **Category: HSMC** **(Common to All)**					
Course Code	:	**B24IKK610**	CIE	:	100 Marks
Teaching Hours L:T:P:S	:	2:0:0:0	SEE	:	-
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	-

Course Learning Objective is	
1.	To Understand the knowledge on basics of research and its types.
2.	To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3.	To learn Ethics in Engineering Research.
4.	To Discuss the concepts of Intellectual Property Rights in engineering.

Module– 1	**No. of Hours**
Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	6
Module– 2	**No. of Hours**
Literature Review and Technical Reading: New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. **Attributions and Citations:** Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	6
Module– 3	**No. of Hours**
Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents:** Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting. **Process of Patenting:** Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained? Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.	6
Module– 4	**No. of Hours**
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases. **Trademarks:** Eligibility Criteria. Who Can Apply for a Strademark? Acts and Laws.	6

Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company v/s. Bisleri International Pvt. Ltd.	
Module– 5	**No. of Hours**
Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co. **Geographical Indications:** Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India. **Case Studies on Patents.** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**	6

Course Outcomes: At the end of the course, the students will be able to	
CO1	To know the meaning of engineering research.
CO2	To know the procedure of the literature Review and Technical Reading.
CO3	To understand the fundamentals of the patent laws and drafting procedure.
CO4	Understanding the copyright laws and subject matters of copyrights and designs.
CO5	Understanding the basic principles of design rights.

Text Books	
1.	Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.
Reference Text Books	
1.	David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4
2.	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

ASSESSMENT DETAILS (CIE only)
The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks (40 marks out of 50).

CONTINUOUS INTERNAL EVALUATION (MCQs)

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment-1**	**50**	**30 (Average of Best two Assessments)**	**50**
	Internal Assessment-2	**50**		
	Internal Assessment-3	**50**		
AAT	**Two Assessments as per regulations**	**20**	**20**	
SEE	**Semester End Examination**	**50**	**50**	**50**
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	0	0	0	0	3	2	0	0	0	0
CO2	0	0	0	0	0	1	1	0	0	0	1
CO3	0	0	0	0	0	2	2	0	0	0	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

SEMESTER-V & VI					
NATIONAL SERVICE SCHEME (NSS) **Category: NCMC**					
Course Code	:	B24NCK591/691	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	---
Total Hours	:	50	Total	:	100 Marks
Credits	:	--	SEE Duration	:	--

Course Objectives	
1.	Understand the community in which they work
2.	Identify the needs and problems of the community and involve the min problem-solving
3.	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4.	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes
5.	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

CONTENT	**No. of Hours**
1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management–Public, Private and Govt. organization. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques–Role of different take holders–Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India.Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum 5 programs). 10. Social connect and responsibilities. 11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events/ workshops / seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure. **NOTE:** Students have to take up any one activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp. CIE will be evaluated based on their presentation, approach and implementation strategies.	50

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

CO-PO Mapping

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

Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped

SEMESTER-V & VI NATIONAL CADET CORPS (NCC) Category: NCMC					
Course Code	:	B24NCK592/692	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	--
Total Hours	:	50	Total	:	100 Marks
Credits	:	--	SEE Duration	:	--

Course Objectives	
1.	To develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit, and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance, and dignity of labour in the cadets.
2.	To create a pool of organized, trained, and motivated youth with leadership qualities from all walks of life, who will serve the Nation regardless of which career they choose
3.	To provide a conducive environment to motivate young Indians to choose the Armed Forces as a career

Content	No. of Hours
Unit 1. Personality Development: Group Discussions - Change your Mindset, Public Speaking. **Unit 2.LeadershipDevelopment:** Case Studies– APJ Abdul Kalam, DeepaMalik, Maharana Pratap, N Narayan Murthy etc. **Unit 3. Disaster management:** Disaster Management Capsule, Organization, Types of Disasters, Essential Services, Assistance, Civil Defense Organization. **Unit 4.Adventure:**AdventureActivities **Unit 5. Border & Coastal Areas:** History, Geography &Topography of Border/ Coastal Areas. **Unit 6. Drill:** Arm Drill, Rifle ke saath Savdhan, Vishram aur Aram se, Rifle ke saath Parade Paraur Saj, Riflekesaath Visarjan, LineTod, Bhumi Shastra aur Uthao Shastra, BagalShastra aur Baju Shastra. **Unit 7.WeaponTraining**: Short Range firing. **Unit 8.MapReading:**SettingofMap,FindingsNorthandOwnPosition **Unit 9.Field Craft & Battle Craft:** Observation, Camouflage, Concealment. **Unit 10. Obstacle Training:** Obstacle training - Introduction, Safety-measures, Benefits. Obstacle Course- Straight balance, Clear Jump, Gate Vault, Zig- Zag Balance, High Wall	50

SEMESTER-V & VI					
PHYSICAL EDUCATION(PE) **Category: NCMC**					
Course Code	:	B24NCK593/693	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	--
Total Hours	:	--	Total	:	100 Marks
Credits	:	--	SEE Duration	:	--

Semester	Course
III	Fitness Components Kabaddi / KhoKho
IV	Athletics Volleyball Throw ball
V	Athletics Football / Hockey
V	Athletics Cricket / Base ball
VI	Athletics Netball / Basketball
VI	Individual Games Handball / Badminton

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to1 Credit (Except Languages)
- Two Hours of Practical is equal to 1 Credit
- SEE: Semester End Examination
- CIE: Continuous Internal Examination
- L+T+P: Lecture + Tutorial + Practical

Guideline for Athletic and Sports

Semester & Course Code	Course Title	Content	No. of Hours
3rd Semester B24NCK393	**Fitness Components** Speed Strength Endurance Agility Flexibility	Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. ***Practical Components: Speed, Strength, Endurance, Flexibility, and Agility*** **KABADDI** **A. Fundamental skills** ➢ Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. ➢ Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. ➢ Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	Total-32 hours 2 hours / week
	Kho kho	**A. Fundamental skills** ➢ Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. ➢ Skills in running: Chain Play, Ring play and Chain & Ring mixed play. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	
	Kabaddi	**A. Fundamental skills** 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials**	

4th Semester **B24NCK493**	**Athletics** **Track-**Sprints **Jumps-**Long Jump **Throws-**Shot Put	**Track Events** ➢ Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. ➢ Acceleration with proper running techniques. ➢ Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. **Long Jump**: Approach Run, Take-off, Flight in the air (Hang Style / Hitch Kick) and Landing **Shot put:** Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique)	Total-32 hours 2 hours / week
	Volleyball	**A. Fundamental skills** Service: Under arm service, Side arm service, Tennis service, Floating service. Pass: Under arm pass, Over head pass. Spiking and Blocking. Game practice with application of Rules and Regulations **B. Rules and their interpretation and duties of officials.**	
	Throw ball	**A. Fundamental skills** Overhand service, Side arm service, two hand catching, one hand overhead return, side arm return. **B. Rules and their interpretations and duties of officials**	

5th Semester **B24NCK593**	**<u>Athletics</u>** **Track-11**0&400 Meters Hurdles **Jumps-**High Jump **Throws-**Discuss Throw	**110 Meters and 400 Meters:** Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles Crouch start (its variations) use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. **High jump**: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. **Discus Throw**: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	

5th Semester **B24NCK593**	Football	**A. Fundamental Skills** ➢ Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. ➢ Trapping: Trapping-the Rolling ball, and the Bouncing ball with sole of the foot. ➢ Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. ➢ Heading: In standing, running and jumping condition. ➢ Throw-in: Standing throw-in and Running throw-in. ➢ Feinting: With the lower limb and upper part of the body. ➢ Tackling: Simple Tackling, Slide Tackling. ➢ Goal Keeping: Collection of Ball, Ballclearance-kicking, throwing and deflecting. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	Total-32 hours 2 hours / week
	Hockey	**A. Fundamental Skills** ➢ Passing: Short pass, Long pass, push pass, hit ➢ Trapping. ➢ Dribbling and Dozing. ➢ Penalty stroke practice. ➢ Penalty corner practice. ➢ Tackling: Simple Tackling, Slide Tackling. ➢ Goal Keeping, Ball clearance-kicking, and deflecting. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Athletics **Track**-Relays **Jumps**-Triple Jump **Throws**-Javelin Throw	**Relay Race**: Starting, Baton Holding / Carrying, Baton Exchange in between zone, and Finishing. **Triple Jump**: Approach Run, Take-off, Flight in the Hop, Step, Jump and Landing. **Javelin Throw**: Grip, Carry, and Recovery (3/5 Impulse stride). Release.	Total-32 hours 2 hours / week
	CRICKET	**A. Fundamental Skills** ➢ Batting-Forward Defense Stroke, Backward Defense Stroke, Off Drive, On Drive, Straight Drive, Cover Drive, Square Cut. ➢ Bowling-Out-swing, In-swing, Off Break, Leg Break and Googly. ➢ Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn. ➢ Wicket Keeping **B. Rules and their interpretation and duties of officials.**	

	BASEBALL	**A. Fundamental Skills** Player Stances–walking, extending walking, L stance, cat stance. Grip – standard grip, choke grip. Batting – swing and bunt. Pitching. Baseball: Slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball. **B. Rules and their interpretation and duties of officials.**	

6th Semester **B24NCK693**	**Athletics** Combined Events-Heptathlon & Decathlon **Jumps**- Pole Vault **Throws**-Hammer Throw	Combined Events: Heptathlon all the7 events Decathlon: All10Events **Pole Vault**: Approach Run, Planting the Pole, Take-off, Bar Clearance and Landing. **Hammer Throw**: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	Total-32 hours 2 hours / week
	Basketball	**A. Fundamental Skills** ➢ Passing: Two hands Chest Pass, Two hands Bounce Pass, One hand Base ball Pass, Side arm Pass, Overhead Pass, Hook Pass. ➢ Receiving: Two hand receiving, one hand receiving, Receiving in stationary position, receiving while jumping and Receiving while Running. ➢ Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. ➢ Shooting: Lay-up shot and its variations, one hand set shot, two hands jump shot, Hook shot, Free Throw. ➢ Rebounding: Defensive rebound and Offensive rebound. ➢ Individual Defence: Guarding the player with the ball and without the ball, pivoting. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Netball	**A. Fundamental skills** ➢ Catching: one handed, two handed, with feet grounded and in flight. ➢ Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). ➢ Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. ➢ Shooting: One hand, forward step shot, and back ward step shot.	

		➢ Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. ➢ Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. ➢ Intercepting: Pass and shot. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Individual games Shuttle Badminton	**A. Fundamental skills** ➢ Basic Knowledge: Various parts of the Racket and Grip. ➢ Service: Short service, Long service, Long-high service. ➢ Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	Total-32 hours 2 hours / week
	Table Tennis	**A. Fundamental skills** ➢ Basic Knowledge: Various parts of the Racket and Grip (Shake Hand & Pen Hold Grip). ➢ Stance: Alternate & Parallel. ➢ Push and Service: Backhand & Forehand. ➢ Chop: Backhand & Forehand. ➢ Receive: Push and Chop with both Backhand & Forehand. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Hand ball	**A. Fundamental skills** ➢ Catching, Throwing and Ball control, ➢ Goal Throws: Jump shot, Center shot, Dive shot, Reverse shot. ➢ Dribbling: High and low. ➢ Attack and counter attack, simple counter attack, counter attack from two wings and center. ➢ Blocking, Goal Keeping and Defensive skills. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Ball Badminton	**A. Fundamental skills** ➢ Basic Knowledge: Various parts of the Racket and Grip. ➢ Service: Short service, Long service, Long-high service. ➢ Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. ➢ Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	

REFERENCES

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et al. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P. N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey, H. C. Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Of fences for winning basketball, Parker Publishing Co., New York. 13 Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
13. Sally Kus, Coaching Volleyball Successfully, Human Kinetics.
14. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
15. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata

SEMESTER-V & VI					
YOGA Category: NCMC					
Course Code	:	B24NCK594/694	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	--
Total Hours	:	--	Total	:	100 Marks
Credits	:	--	SEE Duration	:	--

Semester	Course
III Semester	1) Introduction of Yoga, Aim and Objectives of yoga, Prayer 2) Brief introduction of yogic practices for common man 3) Rules and regulations 4) Misconceptions of yoga 5) Suryanamaskara 6) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line
IV Semester	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
V Semester	1) Patanjali's Ashtanga Yoga 2) Surya namaskara 3) Different types of Asanas a. Sitting b. Standing c. Proneline d. Supineline 4) Kapalbhati 5) Pranayama

	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
VI Semester	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
	1) Patanjali's AshtangaYoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama 6) Shat Kriyas

Notes:

- One Hour of Lectureisequalto1Credit
- One Hour of Tutorial is equal to 1Credit (Except Languages)
- Two Hours of Practical is equal to 1Credit
- SEE: Semester End Examination
- CIE: Continuous Internal Examination
- L+T+P: Lecture + Tutorial + Practical

Guidelines for Yoga Syllabus

Semester & Course Code	Course Title	Content	No. of Hours
3rd Semester B24NCK394	Introduction of Yoga, Aim and Objectives of yoga, Prayer	Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer	Total-32 hours 2 hours / week
	Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health	
	Rules and regulations	Rules to be followed during yogic practices by practitioner	
	Misconceptions of yoga	Yoga its misconceptions, Difference between yogic and non yogic practices.	
	Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds	
	Different types of Asanas Sitting ➢ Padmasana ➢ Vajrasana Standing ➢ Vrikshana ➢ Trikonasana Prone line ➢ Bhujangasana ➢ Shalabhasana Supine line ➢ Utthitadvipadasana ➢ Ardhahalasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana.	

4th Semester **B24NCK494**	Patanjali's Ashtanga Yoga ➢ Yama ➢ Niyama	Patanjali's Ashtanga Yoga its need and importance. Yama: Ahimsa, satya, asteya, brahmacarya, aparigraha. Niyama: shoucha, santosh, tapa, svaadhyaya, Eshvara pranidhan	Total-32 hours 2 hours / week
	Suryanamaskara	Suryanamaskar 12 count, 4 rounds	
	Different types of Asanas Sitting ➢ Sukhasana ➢ Paschimottanasana Standing ➢ Ardhakati Chakrasana ➢ Parshva Chakrasana Prone line ➢ Dhanurasana Supine line ➢ Halasana ➢ Karna Peedasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana.	
	Kapalabhati	Meaning, importance and benefits of Kapalabhati. 40 strokes/min, 3 rounds	
	Pranayama ➢ Suryanuloma–Viloma ➢ Chandranuloma-Viloma ➢ Suryabhedana ➢ ChandraBhedana ➢ Nadishodhana	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

5th Semester **B24NCK594**	Ashtanga Yoga ➢ Asana ➢ Pranayama	Patanjali's Ashtanga Yoga its need and importance.	Total-32 hours 2 hours / week
	Suryanamaskara	Suryanamaskar 12 count, 6 rounds	
	Different types of Asanas Sitting ➢ Ardha Ushtrasana ➢ Vakrasana Standing ➢ Urdhva Hastothanasana ➢ Hastapadasana Prone line ➢ Padangushtha Dhanurasana Supine line ➢ Sarvangasana ➢ Chakraasana	Asana, Need, importance of Asana. Different types. Asana its meaning by name, technique, precautionary measures and benefits of each asana.	
	Kapalabhati	Revision of practice 50 strokes/min, 3 rounds	
	Pranayama ➢ Surya Bhedana ➢ Ujjayi	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, Precautionary measures and benefits of each Pranayama.	
	Ashtanga Yoga ➢ Pratyahara ➢ Dharana	Patanjali's Ashtanga Yoga its need and importance.	Total-32 hours 2 hours / week
	Suryanamaskara	Revisionofpractice12count, 8 rounds	
	Different types of Asanas Sitting ➢ AakarnaDhanurasana ➢ YogamudrainPadmasana Standing ➢ ParivrittaTrikonasana ➢ Utkatasana Prone line ➢ PoornaBhujangasana/	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana.	

	Rajakapotasana Supine line ➢ Navasana/Noukasana ➢ Pavanamuktasana		
	Kapalabhati	Revision of practice 60 strokes/min, 3 rounds	
	Pranayama ➢ Sheetali ➢ Sheektari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

6th Semester **B24NCK694**	Ashtanga Yoga ➢ Dhyana (Meditation) ➢ Samadhi	Patanjali's Ashtanga Yoga its need and importance.	Total-32 hours 2 hours / week
	Suryanamaskara	Revision of practice 12count, 10rounds.	
	Different types of Asanas Sitting ➢ Vibhakta Paschimottanasana ➢ Yogamudra inVajrasana Standing ➢ Parshvakonasana ➢ Ekapadbaddhapadmottanasana Prone line balancing ➢ Mayurasana Supine line ➢ Sarvangasana ➢ Setubandhasana ➢ Shavasanaa (Relaxation poisture)	Asana, Need, Importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana.	
	Kapalabhati	Revision of practice 80 strokes/min, 3 rounds	

	Pranayama ➢ Bhastrika ➢ Bhramari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, Precautionary measures and benefits of each Pranayama.	
	Suryanamaskara	Revision of practice 12count, 12 rounds.	Total-32 hours 2 hours / week
	Different types of Asanas Sitting ➢ Bakasana ➢ Hanumanasana ➢ Ekapada Rajakapotasana Standing ➢ Vatayanasana ➢ Garudasana ➢ Natarajasana Balancing ➢ Sheershasana Supine line ➢ 1.Setubandha Sarvangasana ➢ Shavasanaa (Relaxation poisture)	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana.	
	Kapalabhati	Revision of practice 100 strokes/min, 3 rounds.	
	Pranayama ➢ Nadishodhana ➢ Ujjai ➢ Bhramari	Revision of practices	
	ShatKriyas ➢ Jalaneti & sutraneti ➢ Nouli (only for men) ➢ Sheetkarma Kapalabhati	Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya	

Book for Reference:

- Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
- Tiwari, O P: Asana Why and How

- Ajitkumar: Yoga Pravesha (Kannada)
- Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
- Swami Satyananda Saraswati: Surya Namaskar (BiharSchoolofyoga,Munger)
- Nagendra H R: The art and science of Pranayama
- Tiruka: Shatkriyegalu (Kannada)
- Iyengar B K S: Yoga Pradipika (Kannada)
- Iyengar B K S: Light on Yoga (English)

SEMESTER-V & VI					
MUSIC **Category: NCMC**					
Course Code	:	B24NCK595/695	CIE	:	100 Marks
Teaching Hours L : T : P	:	1:0:0	SEE	:	--
Total Hours	:	--	Total	:	100 Marks
Credits	:	--	SEE Duration	:	--

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

Module – 1	**No. of Hours**
Preamble: Contents of the curriculum intend to promote music as language to develop an analytical, Creative, and intuitive Understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga Tala, Mela.	3
Module – 2	**No. of Hours**
Compositions: Introduction to the types of composition in Carnatic Music- Geethe, Jath i, Swara, Swarajathi, Varna, Krithi, and Thillana, Notation System.	3
Module – 3	**No. of Hours**
Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysoro Vasudevacharya.	3
Module – 4	**No. of Hours**
Music Instruments: Classification and construction of string instruments, wind instrurments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instrum ents	3
Module – 5	**No. of Hours**
Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Botation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in M alahari, and one jathi Swara, One Krithi in a Mela raga	14

Course Outcomes: At the end of the course, the students will be able to	
CO1	Discuss the Indian system of music and relate it to other genres (Cognitive DOmain)
CO2	Experience the emotions of composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)

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

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