



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



Computer Science and Engineering

V and 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.

Computer Science and Engineering

DEPARTMENT VISION

To produce competent professionals who drive research, foster innovation, and develop technologies that address global challenges and inspire future generations.

DEPARTMENT MISSION

1. Provide extensive technical education to produce trained professionals and entrepreneurs.
2. Establish a knowledge environment for progressive research by imparting industrial-based skill development courses on the growth of a modernized environment.
3. Create and develop innovative skills by collaborating with Industries to generate solutions for societal impact with moral standards.
4. To instill lifelong learning, adaptability, and resilience, equipping students to thrive in fast-evolving fields and continuously advance technology.

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: Enable graduates to excel in higher education, conduct impactful research, and succeed in careers or entrepreneurship in Computer Science and Engineering.

PEO2: Ensure graduates develop the skills and mindset to continuously adapt to evolving technologies and acquire new knowledge.

PEO3: Cultivate professionalism and ethics in graduates, enabling them to contribute to societal progress and technological advancement.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Investigate complex problems across various domains, applying appropriate computational techniques to systematic design solutions and evaluate their effectiveness.

PSO2: Apply software engineering principles to design and develop high-quality, innovative software systems, utilizing contemporary and emerging information processing technologies.

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7.	B24CS641	Introduction to Data Structures	49
8.	B24IC642	Introduction to Cyber Security	51
9.	B24CS643	Fundamentals of Operating Systems	53
10.	B24AI644	AI for Everyone	55
11.	B24CS605L	Machine Learning Algorithms Lab	57
12.	B24CS681	Video Creation and Editing	59
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V& VI Semester Common Courses

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3.	B24RMK606	Research Methodology and IPR	5
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DEPARTMENT OF COMPUTER 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	
1.	HSMC	B24CS501	Software Engineering and Project Management	CS	3	0	0	3	50	3	50	100	3
2.	IPCC	B24CS502	Computer Networks	CS	3	0	2	3	50	3	50	100	4
3.	PCC	B24CS503	Theory of Computation	CS	2	2	0	2	50	3	50	100	3
4.	PCC	B24CS504	Artificial Intelligence	CS	3	0	0	3	50	3	50	100	3
5.	PCCL	B24CS505L	Artificial Intelligence Lab	CS	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	CS / 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	CS / CV	2	0	0	0	100	-	-	100	PP
11.	SDC	B24CSP511	Mini-Project	CS	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.



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Professional Elective Courses (PEC) - I			
B24CS561	Computer Vision	B24CS562	Real time Operating System
B24CS563	Fog and Edge Computing	B24CS564	Distributed Computing
Ability Enhancement Course/Skill Enhancement Course (AEC/SEC)-V			
B24CS581	Angular JS Lab	B24CS582	Technical writing using LATEX
B24CS583	Web Technologies	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



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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



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

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	B24CS601	Machine Learning Algorithms	CS	2	2	0	2	50	3	50	100	3
2.	IPCC	B24CS602	Data Mining	CS	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	B24CS605L	Machine Learning Algorithms Laboratory	CS	0	0	2	0	50	3	50	100	1
6.	AEC	B24RMK606	Research Methodology and IPR	CS / IC	1	0	0	1	50	1	50	100	1
7.	SDC	B24PRJ607	Capstone Project work: Phase-I	CS	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	CS	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



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Professional Elective Courses (PEC)-II			
B24CS631	Cloud Computing Architecture	B24CS632	No SQL Database
B24CS633	Compiler Design	B24CS634	Image Processing Analysis
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			
B24CS681	Video Creation and Editing	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.			

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Department of Computer Science and Engineering

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. Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models.	9



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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, 7 th Edition, Tata McGraw Hill.
2.	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6 th 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, 3 rd 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



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Department of Computer Science and Engineering

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
C01	3	2	2	-	-	-	-	-	-	-	1
C02	2	3	3	2	-	-	-	-	1	-	1
C03	2	3	2	2	2	-	-	-	-	-	1
C04	2	2	3	-	1	1	-	2	1	3	1
C05	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

1.	1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi,
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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

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, 3 rd Edition, Pearson Education, 2009.
2.	Peter Linz, An Introduction to formal Languages and Automata, 4 th 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)

- The question paper shall be set for 100 marks and duration of SEE is 3 hours.
- The question paper will have two parts: Part-A and Part-B.
- 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.
- 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.
- 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, 3 rd Edition, Pearson,2015.
2.	Elaine Rich, Kevin Knight, Artificial Intelligence, 3 rd edition,Tata McGraw Hill,2013.
Reference Text Books	
1.	George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5 th 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



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
 (An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Department of Computer Science and Engineering

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) 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 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.	Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 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	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



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
 (An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Department of Computer Science and Engineering

SEMESTER-V					
Real Time Operating System					
Category: PEC - I					
Course Code	:	B24CS562	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 expose the students to the fundamentals of interaction of OS with a computer and User computation.
2.	To teach the fundamental concepts of how process are created and controlled with OS.
3.	To study on programming logic of modeling Process based on range of OS features
4.	To compare types and Functionalities in commercial OS, application development using RTOS
5.	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the Units of the subject for improved employability skills

Module – 1	No.of Hrs
Basic Principles – Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems	9
Module – 2	No.of Hrs
RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks	9
Module – 3	No.of Hrs
Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling – Interrupt processing – Synchronization – Control Blocks – Memory Requirements.	9
Module – 4	No.of Hrs
Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.	9
Module – 5	No.of Hrs
Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application – Case study	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	To understand the Operating System structures and types.
CO2	To Analyze the Insight into scheduling, disciplining of various processes execution.
CO3	To Apply knowledge on various RTOS support modelling
CO4	To Demonstrate commercial RTOS Suite features to work on real time processes design.
CO5	To Evaluate the Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design

Text Books	
1	Silberschatz, Galvin, Gagne” Operating System Concepts, 6th ed, John Wiley, 2003
2	Charles Crowley, “Operating Systems-A Design Oriented approach” McGraw Hill, 1997
Reference Text Books	
1	Greg Semeraro “Embedded Real-Time Operating System Design - RTOS.X “(GPS Engineering Consulting, LLC, 2025)
2	Bertolotti and Manduchi “Real-Time Embedded Systems with Open-Source Operating Systems ‘Routledge, recent edition 2025
3	Jonathan W. Valvano “Real-Time Operating Systems for ARM Cortex-M Microcontrollers” 2019, fifth printing



Web links and Video lectures (e-Resources)

1. <https://elearn.nptel.ac.in/shop/completed-courses/short-term-programs-completed/lab-workshop-on-embedded-rtos/>
2. <https://www.youtube.com/watch?v=hS9tx46rJxU>.
3. https://www.youtube.com/watch?v=Jlr7Xm_rIRs.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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	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.
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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
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CO2	2	3	2	2	1	-	-	-	-	-	1
CO3	2	2	3	2	2	-	-	-	-	-	1
CO4	2	2	3	1	3	-	-	2	1	1	1
CO5	1	2	2	1	2	1	1	2	1	2	3

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



Semester-V					
Fog and Edge Computing					
Category: PEC - I					
Course Code	:	B24CS563	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 Fog Computing technologies and its opportunities.
2.	To review underlying technologies, limitations, and challenges along with performance metrics and discuss generic conceptual framework in fog computing.
3.	To learn the techniques for storage and computation in fogs, edges, 5G and clouds.
4.	To impart the knowledge to log the sensor data and to perform further data analytics.
5.	Analyze the performance and issues of the applications developed using fog and edge architecture.

Module – 1	No.of Hrs
Introduction to Fog Computing, Limitation of Cloud Computing, Differences between Cloud and Fog Computing, Advantages, Business Models, Architecture, Opportunities and Challenges.	9
Module – 2	No.of Hrs
Taxonomy and Characteristics, Resource Management Challenge, Optimization Challenges, Miscellaneous Challenges.	9
Module – 3	No.of Hrs
Programming Paradigms, Research Challenges and Research Directions, Fog Protocols, Management and Orchestration of Network Slices in 5G, Fog, Edge and Clouds, Data Management and Analysis in Fog Computing, Case Studies.	9
Module – 4	No.of Hrs
Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog, and M2M. Origins of Edge, Edge Helping Low-End IoT Nodes, Architecture, Edge Helping Higher-Capability.	9
Module – 5	No.of Hrs
Mobile Offloading, Edge Helping the Cloud, Edge for Augmented Reality, Data Processing on the Edge, Dispersed Learning with Edge/Fog Computing, Video Analytics on the Edge, Edge Computing Applications.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the key architectures and basic fundamentals of fog computing.
CO2	Understand the challenges in fog computing.
CO3	Perform fog and edge computing services
CO4	Understand the basic fundamentals of edge computing and Use fog and edge computing services in various applications.
CO5	Analyze and evaluate fog and edge computing solutions for real-world IoT and distributed applications.

Text Books	
1	Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.
2	Wei Change and Jie Wu, Fog/Edge Computing for Security, Privacy and Applications, Springer, 2021.
3	IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806



Reference Text Books

1	Bahga, Arshdeep, and Vijay Madiseti, Cloud computing: A hands-on approach, 2014, 2nd edition, CreateSpace Independent Publishing Platform, USA.
2	Ovidiu Vermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India.

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)

- The question paper shall be set for 100 marks and duration of SEE is 3 hours.
- The question paper will have two parts: Part-A and Part-B.
- 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.
- 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.
- 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	1	2	-	-	-	-	-	-	1
CO3	2	2	1	2	3	-	-	1	-	-	1
CO4	2	2	2	1	2	1	-	1	1	-	1
CO5	1	3	-	2	2	1	1	1	1	1	2

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



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Department of Computer Science and Engineering

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



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Text Books	
1	Kshemkalyani Ajay D, Mukesh Singhal, “Distributed Computing: Principles, Algorithms and Systems”, Cambridge Press, 2011.
2	Mukesh Singhal, Niranjana 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)

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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

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



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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) 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 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. <table><tr><th>Sl.No</th><th>USN</th><th>Student Name</th><th>Subject 1</th><th>Subject 2</th><th>Subject 3</th></tr><tr><td>1</td><td>4XX22XX001</td><td>Name 1</td><td>89</td><td>60</td><td>90</td></tr><tr><td>2</td><td>4XX22XX002</td><td>Name 2</td><td>78</td><td>45</td><td>98</td></tr><tr><td>3</td><td>4XX22XX003</td><td>Name 3</td><td>67</td><td>55</td><td>59</td></tr></table>	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
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 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2 - 4*(1)*(-8)}}{2*1}$ $= \frac{-2 \pm \sqrt{4+32}}{2}$ $\varphi_{\sigma}^{\lambda} A_t = \sum_{\pi \in C_t} \text{sgn}(\pi) \varphi_{\sigma}^{\lambda} \varphi_{\pi}^{\lambda}$ $= \sum_{\tau \in C_{\sigma t}} \text{sgn}(\sigma^{-1} \tau \sigma) \varphi_{\sigma}^{\lambda} \varphi_{\sigma^{-1} \tau \sigma}^{\lambda}$ $= A_{\sigma t} \varphi_{\sigma}^{\lambda}$																								
8.	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries,																								



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	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)

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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					
Web Technologies					
Category: AEC-V					
Course Code	:	B24CS583	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 learn HTML 5 elements and their use.
2.	To use of CSS for enhanced user interface presentation.
3.	To gain knowledge of JavaScript, AJAX and jQuery for dynamic presentation.
4.	To use of PHP to build Web applications.
5.	To design and develop Websites and Web applications.

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



9	Develop jQuery script (with HTML/CSS) for: a. Appends the content at the end of the existing paragraph and list. b. Change the state of the element with CSS style using animate() method c. Change the color of any div that is animated.
10	Develop a JavaScript program with Ajax (with HTML/CSS) for: a. Use ajax() method (without JQuery) to add the text content from the text file by sending ajax request. b. Use ajax() method (with JQuery) to add the text content from the text file by sending ajax request. c. Illustrate the use of getJSON() method in jQuery d. Illustrate the use of parseJSON() method to display JSON values.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Design the experiment for the given problem using HTML, JavaScript and CSS.
CO2	Develop the solution for the given real-world problem using jQuery, Ajax and PHP.
CO3	Analyze the results and produce substantial written documentation.
CO4	Implement client-server web applications integrating database connectivity and server-side scripting.
CO5	Evaluate and debug web applications to ensure correctness, efficiency and user interaction compliance.

ASSESSMENT DETAILS BOTH (CIE AND SEE)

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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 hours.



CO-PO Mapping

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

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) 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 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)

- 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.
- All laboratory experiments are to be included for practical examination.
- Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
- 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.
- 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	:	B24CSP511	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 insufficient description of the technical requirements of the project	Complete explanation of the key concepts but insufficient description of the technical requirements of the project	Complete explanation of the key concepts and strong description of the technical requirements of the project



Department of Computer Science and Engineering

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



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
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Department of Computer Science and Engineering

Semester-VI					
Machine Learning Algorithms					
Category: PCC					
Course Code	:	B24CS601	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	2:2:0:2	SEE	:	50 Marks
Total Hours	:	55	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
Problem Solving: Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)	11
Module – 2	No.of Hrs
Probabilistic Reasoning: Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.	11
Module – 3	No.of Hrs
Supervised Learning: Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests	11
Module – 4	No.of Hrs
Ensemble Techniques and Unsupervised Learning: Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.	11
Module – 5	No.of Hrs
Neural Networks: Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.	11

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use appropriate search algorithms for problem solving
CO2	Apply reasoning under uncertainty
CO3	Build supervised learning models
CO4	Build ensembling and unsupervised models
CO5	Build ensembling and unsupervised models

Text Books	
1.	Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2.	Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
Reference Text Books	
1.	Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2007
2.	Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3.	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006



Web links and Video lectures (e-Resources)

1. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (<http://nptel.ac.in/>)

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



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Semester-VI					
Data Mining					
Category: IPCC					
Course Code	:	B24CS602	CIE	:	50 Marks
Teaching Hours L:T:P:S	:	3:0:2:0	SEE	:	50 Marks
Total Hours	:	45+30	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To be familiar with the concepts of data warehouse and data mining.
2.	To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.

Module – 1	No.of Hrs
Data Warehouse: Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.	9
Module – 2	No.of Hrs
Business Analysis: Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.	9
Module – 3	No.of Hrs
Data Mining: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.	9
Module – 4	No.of Hrs
Association Rule Mining and Classification: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction	9
Module – 5	No.of Hrs
Clustering and Trends In Data Mining: Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply data mining techniques and methods to large data sets.
CO2	Use data mining tools.
CO3	Compare and contrast the various classifiers

Text Books	
1	Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2	Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
Reference Text Books	
1	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2	K.P. Soman, Shyam Diwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3	G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.



4	Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.
Web links and Video lectures (e-Resources)	
1.	https://nptel.ac.in/courses/106/106/106106093/
2.	https://nptel.ac.in/courses/106/106/106106093/
3.	https://nptel.ac.in/courses/106/106/106106093/

LABORATORY

Practical Component of IPCC (10 Experiments)

Sl. No	Name of the experiment
1.	Creation of a Data Warehouse
2.	Apriori Algorithm
3.	FP-Growth Algorithm
4.	K-means clustering
5.	One Hierarchical clustering algorithm
6.	Bayesian Classification
7.	Decision Tree
8.	Support Vector Machines
9.	Applications of classification for web mining
10.	Case Study on Text Mining or any commercial application

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)	50/2 = 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
	Internal Test	50	20	
Total Marks				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	2	2	-	-	-	-	1	1
CO2	3	3	-	2	1	2	1	-	-	2	2
CO3	3	3	2	2	3	-	-	-	-	1	1
CO4	3	2	2	2	3	-	-	-	-	1	1
CO5	3	3	2	2	3	-	-	-	-	1	1

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



Semester-VI				
Cloud Computing Architecture				
Category: PEC-II				
Course Code	:	B24CS631	CIE	: 50 Marks
Teaching Hours L:T:P:S	:	3:0:0:3	SEE	: 50 Marks
Total Hours/Semester	:	45	Total	: 100 Marks
Credits	:	3	SEE Duration	: 3 Hrs

Course Learning Objective is	
1.	To introduce the rationale behind the cloud computing revolution and the business driver.
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 trade-offs.
4.	To realize the importance of Cloud Virtualization, Abstraction's, Enabling Technologies and cloud security

Module – 1	No. of Hrs
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 Hrs
Virtual Machines and Virtualization of Clusters and Data Centres: 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 Centre Automation.	9
Module – 3	No. of Hrs
Cloud Platform Architecture over Virtualized Data centres: Cloud Computing and Service Models, Data Centre 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 Hrs
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 Defence Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centres.	9
Module – 5	No. of Hrs
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.

Text Books	
1.	Kai Hwang, Geoffrey C Fox, and Jack J Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, Elsevier 2012



2.	Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, 2nd Edition, Elsevier 2018
3.	Google Cloud Teaching Resources – LMS [for practical component]
4.	AWS Cloud Developing – AWS Academy Courses [for practical component]

Reference Text Books

1.	Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi, Mastering Cloud Computing McGrawHill Education, 1st Edition, 2017
2.	Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw-Hill Education, 2017.
3.	George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Publication, 1st Edition, 2009
4.	John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2 nd Edition, 2009.

Web links and Video lectures (e-Resources)

1.	https://freevideolectures.com/course/4639/nptel-cloud-computing/1 .
2.	https://www.youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J
3.	https://www.youtube.com/watch?v=EN4fEbcFZ_E
4.	https://www.youtube.com/watch?v=RWgW-CgdIk0
5.	https://www.geeksforgeeks.org/virtualization-cloud-computing-types/
6.	https://www.javatpoint.com/cloud-service-provider-companies

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)

- The question paper shall be set for 100 marks and duration of SEE is 3 hours.
- The question paper will have two parts: Part-A and Part-B.
- 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.
- 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.
- 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	-	-	-	3	1	-	-	1	-
CO2	2	2	-	-	-	2	1	-	-	2	-
CO3	1	1	-	-	-	1	2	-	-	2	-
CO4	1	1	-	-	-	1	2	-	-	1	-
CO5	1	1	-	-	-	1	2	-	-	1	-

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



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Semester-VI					
No SQL Database					
Category: PEC II					
Course Code	:	B24CS632	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 fundamentals and applications of Big Data analytics.
2	To explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Tools.
3	To illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
4	To employ MapReduce programming model to process the big data.
5	To understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

Module - 1	No. of Hrs
Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.	9
Module - 2	No. of Hrs
Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools (T2): Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.	9
Module - 3	No. of Hrs
No SQL Big Data Management, Mongo DB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	9
Module - 4	No. of Hrs
Introduction, MapReduce Map Tasks, Reduce Tasks and Map Reduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	9
Module - 5	No. of Hrs
Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand fundamentals and applications of Big Data analytics.
CO2	Investigate Hadoop framework, Hadoop Distributed File system and essential Hadoop tools.
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Apply Machine Learning algorithms for real world big data, web contents and Social Networks to provide analytics with relevant visualization tools.



Text Books	
1	Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2	Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 stEdition, Pearson Education, 2016. ISBN13: 978-9332570351
Reference Text Books	
1	Tom White, "Hadoop: The Definitive Guide", 4 th Edition, O'Reilly Media, 2015.ISBN-13: 978-9352130672
2	Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 stEdition, Wrox Press, 2014ISBN-13: 978-8126551071
3	Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1 stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4	ArshdeepBahga, Vijay Madiseti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
Web links and Video lectures (e-Resources)	
1. https://www.youtube.com/watch?v=n_Krer6YWY4 2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview 3. https://www.digimat.in/nptel/courses/video/106104189/L01.html 4. https://web2.qatar.cmu.edu/~mhhammou/15440-f19/recitations/Project4_Handout.pdf	

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	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	3	3	3	2	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	1	-	-	1
CO5	3	3	3	3	3	1	-	-	2	1	1	2



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
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Department of Computer Science and Engineering

Semester-VI					
Compiler Design					
Category: PEC II					
Course Code	:	B24CS633	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 working of language processors
2	To apply different phases of designing a compiler
3	To illustrate lexical analysis
4	To explain the need of real time operating system for embedded system applications

Module - 1	No. of Hrs
Introduction: Language Processors, The structure of Compiler, The evolution of Programming Languages, The science of Building a Compiler, Applications of Compiler Technology, Programming Language Basics. A Simple Syntax Directed Translator: Introduction, Syntax Definition, Syntax Directed Translation, Parsing.	9
Module - 2	No. of Hrs
Lexical Analysis: The Role of Lexical Analyzer, Input buffering, Specification of Tokens, Recognition of Tokens, The lexical Analyzer Generator Lex Syntax Analysis: Introduction, Context Free Grammars, Writing a Grammar.	9
Module - 3	No. of Hrs
Top-Down Parsing: Recursive Descent Parsing, First and Follow, LL(1) Grammars. Bottom Up Parsing: Reductions, Handle Pruning, Shift Reduce Parsing.	9
Module - 4	No. of Hrs
Introduction to LR Parsing: Simple LR, LR Parsing Algorithm, Construction of SLR parsing Tables, Viable Prefixes, Syntax Directed Definitions, Evaluation Orders for SDD.	9
Module - 5	No. of Hrs
Variants of Syntax Trees, Three Address Code, Types and Declarations. Control Flow Code generation: Issues in the Design of a Code Generator, The target language.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the different phases of compiler design techniques..
CO2	Analyse the working of lexical analyser in design of compilers.
CO3	Design syntax analyser using top down and bottom up approaches.
CO4	Illustrate syntax-directed translation for a given grammar.
CO5	Explain intermediate code representation and code generation of compilers.

Text Books	
1	Compilers: Principles, Techniques, and Tools, A. Aho, M. Lam, R. Sethi, and J. Ullman. 2nd Edition, Pearson.
Web links and Video lectures (e-Resources)	
1. http://www.digimat.in/nptel/courses/video/106104123/L01.html	

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	—	—	—	—	—	—
CO2	3	3	2	2	2	—	—	—	—	—	—
CO3	3	3	3	2	2	—	—	—	—	—	—
CO4	3	3	3	3	2	—	—	—	—	—	—
CO5	3	3	3	2	2	—	—	—	—	—	—



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Semester-VI					
Image Processing Analysis					
Category: PEC - II					
Course Code	:	B24CS634	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 fundamental concepts of digital image processing, including image formation, visual perception, and image acquisition.
2	To apply spatial domain techniques such as sampling, quantization, intensity transformations, histogram processing, and spatial filtering for image enhancement.
3	To understand and use frequency domain methods including the 2-D Discrete Fourier Transform and frequency domain filtering.
4	To analyze and restore degraded images using noise models and restoration techniques.
5	Apply morphological and color image processing techniques for effective image analysis and interpretation.

Module – 1	No.of Hrs
Digital Image Fundamentals: What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.	9
Module – 2	No.of Hrs
Image Enhancement in the Spatial Domain: Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	9
Module – 3	No.of Hrs
Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.	9
Module – 4	No.of Hrs
Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.	9
Module – 5	No.of Hrs
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing. Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Describe the fundamentals of digital image processing.
CO2	Understand image formation and the role human visual system plays in perception of gray and color image data.
CO3	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO4	Design and evaluate image analysis techniques.
CO5	Conduct independent study and analysis of image Enhancement and restoration techniques.

Text Books	
1	Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3 rd Edition 2010.



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Reference Text Books

1	Digital Image Processing- S.Jayaraman, S. Esakkirajan, T. Veerakumar, TataMcGrawHill2014.
2	Fundamentals of Digital Image Processing- A K. Jain, Pearson 2004.
3	Image Processing analysis and Machine vision with Mind Tap by Milan Sonka and Roger Boile, Cengage Publications, 2018.

Web links and Video lectures (e-Resources)

1.	https://onlinecourses.nptel.ac.in/noc21_ee78/preview
2.	https://www.sciencedirect.com/journal/digital-signal-processing

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)

- The question paper shall be set for 100 marks and duration of SEE is 3 hours.
- The question paper will have two parts: Part-A and Part-B.
- 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.
- 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.
- 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	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	2	3	2	1	3	-	-	-	-	-	-
CO4	2	3	3	2	3	-	-	-	-	-	-
CO5	2	2	1	3	2	-	-	-	-	-	-

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



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

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



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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



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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)

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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 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



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Semester-VI					
AI for Everyone					
Category: OEC -I					
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, <i>AI for Everyone</i> , DeepLearning.AI, 2019.
2.	Ajay Agrawal, Joshua Gans, and Avi Goldfarb, <i>Prediction Machines: The Simple Economics of Artificial Intelligence</i> , Harvard Business Review Press, 2018.

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



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	1	-	1	-	1	-	1
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



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST
Rajarajeswari College of Engineering
 (An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Department of Computer Science and Engineering

Semester-VI					
Machine Learning Algorithms Laboratory					
Category: PCCL					
Course Code	:	B24CS605L	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 A* Search algorithm.
2.	Implement AO* Search algorithm.
3.	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4.	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets
7.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

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) 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).



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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

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



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Department of Computer Science and Engineering

Semester-VI					
Video Creation And Editing					
Category: AEC – VI					
Course Code	:	B24CS681	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 students to the fundamentals of video storytelling, scripting, and storyboarding.
2.	To provide knowledge of pre-production planning including budgeting, scheduling, and casting.
3.	To familiarize students with single-camera and documentary production techniques.
4.	To develop skills in proposal writing, pitching, and media treatment preparation.
5.	To train students in post-production editing, sound design, and final video finishing.

Sl. No	List of Experiments
1	Concept Development and Movie Synopsis Writing Individual or team-based writing of a short film or documentary synopsis.
2	Story Presentation and Peer Review Team presentation of story ideas in class with feedback and refinement.
3	Scriptwriting and Storyboarding Individual preparation of screenplay format and visual storyboard.
4	Pre-Production Planning Preparation of personnel roles, budgeting, scheduling, location scouting, casting, and legal documentation.
5	Single Camera Production Techniques Study of camera angles, lighting, framing, and basic cinematography practices.
6	Documentary Production Exercise Planning and shooting a short documentary based on real-world themes.
7	Proposal Writing and Pitch Development Writing project overview, media treatment, summary, and pitch presentation.
8	Documentary and Animation Treatment Writing Development of narrative flow, visual style, and audience approach.
9	Post-Production Editing and Sound Design Video editing, transitions, subtitles, background score, and audio synchronization.
10	Final Output and Project Presentation Rendering, quality checking, and final screening with evaluation.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Develop creative story concepts, scripts, and storyboards for video projects.
CO2	Organize and execute pre-production activities effectively.
CO3	Apply appropriate camera and documentary production techniques.
CO4	Prepare professional project proposals, treatments, and pitch documents.
CO5	Design and produce a complete video project using editing and sound design tools.



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 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)

- 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.
- All laboratory experiments are to be included for practical examination.
- Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
- 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.
- 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	3	2	1	—	—	2	2	2	—
CO2	2	3	3	2	1	—	—	2	2	2	2
CO3	2	2	3	3	2	—	—	2	2	2	2
CO4	2	2	3	2	2	—	—	2	3	3	2
CO5	2	2	3	3	3	—	—	2	2	2	3

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 manual mode, 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)

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 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)

- 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.
- All laboratory experiments are to be included for practical examination.
- Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
- 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.
- 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	-	3	-	-	-	-	1	-
CO2	2	3	2	2	3	-	-	-	1	-	-
CO3	2	2	3	-	3	-	-	-	2	-	1
CO4	2	2	3	3	3	1	-	-	2	1	2

Level3 -High, Level2- Moderate, Level1 - Low



Semester-VI					
GENERATIVE AI					
Category: AEC-VI					
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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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)

- 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.
- All laboratory experiments are to be included for practical examination.
- Evaluation of test write-up, conduction procedure, result and viva will be conducted jointly by examiners.
- 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.
- 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	3	3	-	-	-	-	2	2	-	-
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					
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, effectively managing state with hooks and lifecycle methods .
2.	To introduce, how to pass data dynamically between parent and child components using props, ensuring modular and reusable component design.
3.	To create dynamic and responsive applications, integrating forms, validation, task management systems, and styled components.
4.	To use React Router for navigation, external API integration for dynamic data handling, and CSS styling techniques for 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> content as the user types.
2	Develop a React application that demonstrates the use of props to pass data from a parent component to child components. The application should include the parent component named App that serves as the central container for 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 copyright information) from the App component to the Header and Footer components using props. Ensure that the content displayed in the Header and Footer components is dynamically updated based on the data received from the parent component.
3	Create a Counter Application using React that demonstrates state management with the useState hook. Display the current 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 the counter'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 increment or decrement step value.
4	Develop a To-Do List Application using React functional components that demonstrates the use of the useState hook 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 render the list of tasks below the input field. Ensure each task is displayed in a user-friendly manner. Allow users to delete 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. Create two 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 FigureList component to dynamically render multiple BasicFigure components. Pass image URLs and captions as props from the FigureList component to each BasicFigure component. Style the BasicFigure components to display the image and caption in an aesthetically pleasing manner. Arrange the BasicFigure components within the FigureList in a grid or list format. Allow users to add or remove images dynamically. Add hover effects or animations to the images for an interactive experience.
6	Design and implement a React Form that collects user input for name, email, and password. Form Fields are Name, 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 password length or complexity. Display error



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	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 data upon 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, including their name, profile picture, and bio. The component should demonstrate flexibility by utilizing both external CSS and inline styling for its design. Display the following information: Profile picture, User's name, A short bio or description. 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 the ProfileCard to be visually appealing and responsive. Ensure the profile picture is displayed as a circle, and the name and bio are appropriately styled. Add hover effects or animations to enhance interactivity. Allow the background 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 include the following functionalities: Provide a form where users can add tasks along with due dates. The form includes task name, Due date, An optional description. Display a list of tasks dynamically as they are added. Show relevant details like task name, due date, and completion status. Include a filter option to allow users to view all Tasks and Display all tasks regardless of status. Show only tasks marked as completed. Show only tasks that are not yet completed.
9	Design a React application that demonstrates the implementation of routing using the react-router-dom library. The application should include the Navigation Menu: Create a navigation bar with links to three distinct pages, Home, About, Contact. Develop separate components for each page (Home, About, and Contact) with appropriate content to differentiate them. Configure routes using react-router-dom to render the corresponding page component based on the selected link. Use BrowserRouter and Route components for 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)

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 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	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)

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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 perfluorocarbons (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 Rompolksi, McGraw-Hill eBook. 16 th 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 (Average of Best two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
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" 3 rd 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.	
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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.
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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 Nejekar, 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 6 th 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
- Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. - Waste management–Public, Private and Govt. organization. - Setting of the information imparting club for women leading to contribution in social and economic issues. - Water conservation techniques–Role of different take holders–Implementation. - Preparing an actionable business proposal for enhancing the village income and approach for implementation. - Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. - Developing Sustainable Water management system for rural areas and implementation approaches. - 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. - Spreading public awareness under rural outreach programs.(minimum 5 programs). - Social connect and responsibilities. - Plantation and adoption of plants. Know your plants. - Organize National integration and social harmony events/ workshops / seminars. (Minimum 02 programs). - 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. Leadership Development: Case Studies– APJ Abdul Kalam, Deepa Malik, 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: Adventure Activities 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 Para aur Saj, Rifle ke saath Visarjan, Line Tod, Bhumi Shastra aur Uthao Shastra, Bagal Shastra aur Baju Shastra. Unit 7. Weapon Training: Short Range firing. Unit 8. Map Reading: Setting of Map, Findings North and Own Position 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 to 1 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
3 rd Semester B24NCK393	Fitness Components	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
	Speed Strength Endurance Agility Flexibility		
	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	



4 th 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	

5 th Semester B24NCK593	Athletics Track-110&400 Meters Hurdles Jumps-High Jump Throws-Discus 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).	
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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.	
	<u>Athletics</u> 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.	
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6th Semester B24NCK693	Athletics Combined Events- Heptathlon & Decathlon Jumps- Pole Vault Throws- Hammer Throw	Combined Events: Heptathlon all the 7 events Decathlon: All 10 Events 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

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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.
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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.
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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 - Sitting - Standing - Prone line - Supine line
IV Semester	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas - Sitting - Standing - Prone line - Supine line 4) Kapalbhathi 5) Pranayama
V Semester	1) Patanjali's Ashtanga Yoga 2) Surya namaskara 3) Different types of Asanas - Sitting - Standing - Proneline - Supineline 4) Kapalbhathi 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) Kapalbhathi 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) Kapalbhathi 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) Kapalbhathi 5) Pranayama 6) Shat Kriyas

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to 1 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



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 Suryanamaskar 12 count, 2 rounds	
	Different types of Asanas Sitting ➤ Padmasana ➤ Vajrasana Standing ➤ Vrikshana ➤ Trikonasana Prone line ➤ Bhujangasana ➤ Shalabhasana Supine line ➤ Utthitadvipadasana ➤ Ardhalasana	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. <u>Yama:</u> Ahimsa, satya, asteya, brahmacarya, aparigraha. <u>Niyama:</u> 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	



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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 ➤ Chakrasana	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.	
	Suryanamaskara	Revision of practice 12 count, 8 rounds	
	Different types of Asanas Sitting ➤ Aakarna Dhanurasana ➤ Yogamudra in Padmasana Standing ➤ Parivritta Trikonasana ➤ Utkatasana Prone line ➤ Poorna Bhujangasana/	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana.	Total-32 hours 2 hours / week



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	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	



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	Pranayama ➤ Bhastrika ➤ Bhramari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, Precautionary measures and benefits of each Pranayama.	
	Suryanamaskara Different types of Asanas Sitting ➤ Bakasana ➤ Hanumanasana ➤ Ekapada Rajakapotasana Standing ➤ Vatayanasana ➤ Garudasana ➤ Natarajasana Balancing ➤ Sheershasana Supine line ➤ 1.Setubandha Sarvangasana ➤ Shavasanaa (Relaxation posture)	Revision of practice 12count, 12 rounds. Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana.	Total-32 hours 2 hours / week
	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 (Kavalayadhama, 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 (Bihar School of yoga, 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 instrumrnts, 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 DOrmain)
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.