EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous Institution Affiliated to Visvesvaraya Technological University (VTU) Belagavi Approved by All India Council for Technical Education (AICTE), New Delhi,Recognized by Govt. of Karnataka, UG Programs Accredited by National Board of Accreditation (NBA) : CSE, ECE & ISE
www.epcet.edu.in

CURRICULUM

Academic Batch 2024 – 2028 (Autonomous)

Undergraduate Bachelor of Engineering Program- B.E

Outcome Based Education (OBE)

V TO VI SEM

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

2024-28

About the Institute

East Point College of Engineering and Technology (EPCET) was established in the year 1999 by M. G. Charitable Trust, Bangalore. The College is located in the eastern part of Bangalore at Bidarahalli, Virgonagar Post, off old Madras Road. It is at a 5 km distance from K R Puram, Bangalore.

The College is affiliated to Visvesvaraya Technological University (VTU), Belgaum. All the undergraduate and postgraduate programs offered at EPCET have the approval of AICTE. The College at present offers programs in Artificial Intelligence and Data Science, Computer Science and Engineering, Information Science and Engineering, Electronics and Communication Engineering, Mechanical Engineering, and Civil Engineering leading to BE degree of VTU. The college is also offering three M. Tech programs- one each in Electronics and Communication, Mechanical Engineering, and Civil Engineering. At EPCET, more than 2000 students studying various programs, and there are more than 110 faculty members with about 25% of them having Ph.D. Qualification. Faculty members, in addition to teaching and routine administrative work, undertake research. A few faculty members work in collaboration with prestigious national laboratories like LRDE- DRDO and publish their research findings in well-known journals. The programs offered by the college were accredited by NBA during 2008-2011, once again the departments
have applied for accreditation of their programs with the NBA. Various NEWS Papers including Times of India have ranked EPCET very high.
All the students of the final year undergo internships in reputed industries and more than 70% of the students get one or the other job placement on campus in companies like VMware, Cognizant, Infosys, Accenture, IBM, Covance, and so on. The departments offer various competency and skill development courses to prepare the students for the job market in addition to industry integrated learning programs (IILP) with CISCO, AWS, Salesforce, Google Cloud, ARM, UiPath, Microsoft, Texas Instrument. A significant number of Alumni have assumed important positions in industry and government. A few alumni have set up their own start-ups in and around Bangalore and a considerable number have settled down overseas. The students actively participate in the intercollegiate sports activities organized by VTU and also in various intercollegiate cultural activities.

The College with a large number of classrooms, seminar halls, well-equipped laboratories, and a library with more than 50000 books is completely Wi-Fi enabled. In the laboratories, industry-standard software is made available for students to learn and practice and the college has subscribed to a large number of technical journals through a consortium approach.

The college encourages faculty members to attend seminars, conferences organized by other Colleges and industries. Also, faculty have been given the freedom to organize seminars, conferences, and faculty development programs annually. Every year at least 5-6 seminars/conferences/FDP is being conducted. A number of seminar halls are available within the college for organizing seminars and conferences. The College has entered into MoU with a number of industries and foreign Universities.

Since the College is located on a multi-college campus, students have opportunities to interact with students of medical, pharmacy nursing, management, commerce, and Science. Students have transport, hostel and sports facilities. There are more than 15 students' clubs for students to participate in various activities and experience.

The College has set an ambitious vision and it's working continuously to adapt newer concepts in teaching, learning, and student assessments to realize its vision through working on its mission. The College aims to increase the students' satisfaction level with a holistic approach to education.

About the department

The Department of Computer Science and Engineering at East Point College of Engineering and Technology (EPCET), established in 1999 and affiliated with VTU, offers a four-year B.E. program with 300 student intakes. Its mission is to provide students with a strong foundation in computer science, programming, and emerging technologies. The curriculum covers a wide range of subjects, including programming languages, algorithms, operating systems, and artificial intelligence. The department also boasts a VTU-recognized research center, well-equipped labs, and a dedicated faculty involved in research and teaching. Graduates have secured admissions to prestigious universities and excelled in leading IT companies.

About the program

Year of Establishment	1999-2000
Name of the Program offered	BE- Computer Science & Engineering
Intake	300

Institute Vision and Mission

Vision

The East Point College of Engineering and Technology aspires to be a globally acclaimed institution, recognized for excellence in engineering education, applied research, and nurturing students for holistic development

Mission

M1: To create Engineering graduates through quality education and to nurture innovation, creativity and excellence in teaching, learning and research.

M2: To serve the technical, scientific, economic and societal developmental needs of our communities.

M3: To induce integrity, teamwork, critical thinking, personality development, and ethics in students and to lay the foundation for lifelong learning.

Department Vision and Mission

Vision

The department aspires to be a center of excellence in Computer Science & Engineering to develop competent professionals through holistic development

Mission

M1: To create successful Computer Science Engineering graduates through effective pedagogies, the latest tools and technologies, and excellence in teaching and learning.

M2: To augment experiential learning skills to serve technical, scientific, economic, and social developmental needs.

M3: To instil integrity, critical thinking, personality development, and ethics in students for a successful career in Industries, Research, and Entrepreneurship.

Program Educational Objectives (PEOs)

PEO-1: To apply knowledge, understanding, and problem-solving skills in computer science to conceptualize, requirement analyze, design, develop, simulate, and test computing systems to carve a successful career in the industry as a computer science engineer.

PEO-2: To strengthen technical and managerial competencies and skills to be able to work in scientific and technological organizations, administrative positions in government, and even take up the entrepreneurial route.

PEO-3: To impart critical thinking, creativity & innovation, collaboration, communication, information literacy, flexibility & adaptability, leadership and responsibility, and social and cross-cultural interaction skills, and an ability to adapt to evolving professional environments.

Program Specific Outcome (PSO)

PSO1: To conceptualize, model, design, simulate, analyze, develop, test, and validate computing systems and solve technical problems arising in the field of computer science & engineering.

PSO2: To specialize in the sub-areas of computer science & engineering systems such as cloud computing, Robotic Process Automation, cyber security, big data analytics, user interface design, and IOT to meet industry requirements.

PSO3: To build innovative solutions to meet the demands of the industry using appropriate tools and techniques.

Program Outcomes as defined by NBA (PO) Engineering Graduates will be able to:

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

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)

EastPoint College of Engineering and Technology

Total Courses

Sl. No	Category	No. of Courses	No. of Credits
1	Humanity and Social Science and management Course (HSMC)	4	6
2	Programming Language Courses (PLC)/Emerging Technology Courses (ETC)	2	6
3	Basic Science Courses (BSC)/-Applied Science Course (ASC)	5	20
4	Integrated Professional Core Course (IPCC)	5	20
5	Professional Core Course (PCC)	9	31
6	Professional Elective Course (PEC)	4	16
7	Open Elective Course (OEC)	2	7
8	Professional Core Course laboratory (PCCL)	5	5
9	Engineering Science Course (ESC)	6	18
10	Ability Enhancement Course (AEC)/Skill Enhancement Course (SEC)/Skill Development Course (SDC)/Universal Human Value Course (UHV)	7	10
11	Internship (INT)	1	5
12	Project (PROJ)	3	16
13	Mandatory Course (Non-credit)- NCMC	3	-
Total		**56**	**160**

V SEMESTER

SOFTWARE ENGINEERING & PROJECT MANAGEMENT			
Course Code	24CS51	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	Theory		

Prerequisite:

Course objectives:

- Outline software engineering principles and activities involved in building large software programs.
- To understand the AGILE process and implementation.
- Recognize the importance Project Management with its methods and methodologies.
- List the software quality standards and outline the practices involved.
- Identify software quality parameters and quantify software using measurements and metrics.

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) need not be a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic andencourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1 — 8 Hours

Software Engineering: The nature of Software, The unique nature of Web Apps, Software Engineering, The software Process, The software Engineering practice, The 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.

TEXT BOOK 1: Chapter 1: 1.1 to 1.6, Chapter 2: 2.1 to 2.5

MODULE-2 — 8 Hours

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.

TEXT BOOK 1: Chapter 3: 3.1 to 3.6, Chapter 4: 4.1 to 4.3

MODULE-3	8 Hours
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. **TEXT BOOK 2: Chapter 1: 1.1 to 1.17, Chapter 2: 2.4 to 2.6**	
MODULE-4	**8 Hours**
Software Effort Estimation: The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, COSMIC Full Function Points, COSMIC II; A Parametric Model, Cost Estimation. **Risk Management:** Risk, Categories of Risk, Risk Management Approaches, and A Framework for dealing with the Risk, Risk Identification, Risk Assessment, Risk Planning, and Risk Management. **TEXT BOOK 2: Chapter 5: 5.4 to 5.7, 5.12, 5.13, 5.14, Chapter 7: 7.2 to 7.9**	
MODULE-5	**8 Hours**
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. **TEXT BOOK 2: Chapter 13: 13.1 to 13.5, 13.7, 13.8** **TEXT BOOK 1: Chapter 26: 26.5 to 26.7**	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: CO1: Differentiate process models to judge which process model has to be adopted for the given scenarios. PO-1,2,3,4 PSO-1,2,3 CO2: Analyze the various AGILE Process Models. PO-1,2,3,4,5 PSO-1,2,3 CO3: Illustrate the role of project planning and project evaluation. PO-1,2,3,4,5,9,10,11 PSO-1,2,3 CO4: Understand the importance of software estimation and risk management. PO-1,2,3,4,5,11 PSO-1,2,3 CO5: Identify appropriate techniques to enhance software quality. PO-1,2,3,4,5,8,9,10 PSO-1,2,3	

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). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and 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:

Three-Unit Tests each of **20 Marks (duration 01 hour)**

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester Two assignments each of 10 Marks
- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester
- Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)
- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks.

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.

2. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.

References:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.
2. “Software Engineering: Principles and Practice", Hans van Vliet, Wiley India, 3rd Edition, 2010.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs68/preview
- https://www.youtube.com/watchv=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nrggx7Pt1G4UAHeFlJ
- http://elearning.vtu.ac.in/econtent/CSE.php
- http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

- *Case study, Scenario-Based Analysis, Team-Based Assignment.*

THEORY OF COMPUTATIONS			
Course Code	24CS52	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	03
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Discrete Mathematics

Course Objectives:

- Understand the foundational concepts of Automata and Theory of Computation.
- Explore different classes of formal languages and their interrelationships.
- Gain knowledge of grammars and recognizers for various formal languages.
- Apply theoretical principles to prove or disprove theorems in automata theory.
- Assess the decidability and computational complexity of problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different approaches and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1	10 Hours
Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions. **TEXT BOOK: Sections 1.1, 1.5, 2.2, 2.3, 2.4, 2.5**	
Module-2	**10 Hours**
Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata. **TEXT BOOK: Sections 3.1, 3.2 (Except 3.2.1), 3.3, 4.1, 4.2**	
Module-3	**10 Hours**
Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. **TEXT BOOK: Sections 5.1, 5.2, 5.4, 6.1, 6.2, 6.3.1, 6.4**	
Module-4	**10 Hours**
Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages. **Case Study:** Transforming Context-Free Grammars into Chomsky Normal Form **TEXT BOOK: Sections 7.1, 7.2, 7.3**	
Module-5	**10 Hours**
Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Undecidability: A Language That Is Not Recursively Enumerable. **Case Study:** Halting Problem, Real-World Implications of Turing Machines **TEXT BOOK: Sections 8.1, 8.2, 8.3, 8.4, 9.1, 9.2**	
Course outcomes (Course Skill Set): At the end of the course, the student will be able to: **CO1:** Apply the fundamentals of automata theory to write DFA, NFA, Epsilon-NFA and conversion between them. (PO – 1,2,3,11 PSO – 1,2,3)	

CO2: Prove the properties of regular languages using regular expressions. (PO – 1,2,3,11 PSO – 1,2,3)

CO3: Design context-free grammars (CFGs) and pushdown automata (PDAs) to represent various formal languages. (PO – 1,2,3,11 PSO – 1,2,3)

CO4: Design Turing machines to solve the computational problems effectively. (PO – 1,2,3,11 PSO –1,2,3)

CO5: Explain the concepts of decidability and undecidability. (PO – 1,2,3,11 PSO – 1,2,3)

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:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the regulations; if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the Institute as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbooks:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman," Introduction to Automata Theory, Languages and Computation", Second Edition, Pearson.

Reference Books:

1. Elain Rich, "Automata, Computability and complexity", 1st Edition, Pearson Education, 2018.
2. K.L.P Mishra, N Chandrashekaran, 3rd Edition, "Theory of Computer Science", PHI, 2012.
3. Peter Linz, "An introduction to Formal Languages and Automata ", 3rd Edition, Narosa Publishers, 1998.
4. Michael Sipser: Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013.
5. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw –Hill Publishing Company Limited, 2013.

Web links and Video Lectures(e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105196/
- https://archive.nptel.ac.in/courses/106/106/106106049/
- https://nptelvideos.com/course.php?id=717
- https://www.coursera.org/learn/cs-algorithms-theory-machines

COMPUTER NETWORKS			
Course Code	24CS53	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 Theory + 20 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The Students Should have knowledge of

- Familiarity with how computers work, including basic hardware components (CPU, memory, storage) and operating systems.
- Basic Programming Skills.
- Networking Terms and basic concepts.

Course Objectives:

This course will enable students to,

- Study the TCP/IP protocol suite, switching criteria and Medium Access Control protocols for reliable and noisy channels.
- Learn network layer services and IP versions.
- Discuss transport layer services and understand UDP and TCP protocols.
- Demonstrate the working of different concepts of networking layers and protocols.

Teaching-Learning Process (General Instructions)

Teachers can use following strategies to accelerate the attainment of the various course outcomes.

1. Chalk and Talk with Black Board
2. ICT based Teaching
3. Demonstration based Teaching

Module-1 **8 Hours**

Introduction: Data Communications, Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer: Transmission media, Guided Media, Unguided Media: Wireless. Switching: Packet Switching and its types.

Textbook: Ch.1.1-1.3,2.1 -2.3,7.1–7.3, 8.3.

Module-2 **8 Hours**

Data Link Layer: Error Detection and Correction: Introduction, Block Coding, Cyclic Codes. Data link control: DLC Services: Framing, Flow Control, Error Control, Connectionless and Connection Oriented, Datalink layer protocols, High Level Data Link Control. Media Access Control: Random Access, Controlled Access. Check Sum and Point to Point Protocol

Textbook: Ch.10.1-10.4,11.1-11.4,12.1-12.2

Module-3 **8 Hours**

Network Layer: Network layer Services, Packet Switching, IPv4 Address, IPv4 Datagram, IPv6 Datagram, Introduction to Routing Algorithms, Unicast Routing Protocols: DVR, LSR, PVR, Unicast Routing protocols: RIP, OSPF, BGP, Multicasting Routing-MOSPF

Textbook: Ch.18.1,18.2,18.4,22.2,20.1-20.3,21.3.2

Module-4 **8 Hours**

Introduction to Transport Layer: Introduction, Transport-Layer Protocols: Introduction, User Datagram Protocol, Transmission Control Protocol: services, features, segments, TCP connections, flow control, Error control, Congestion control.

Textbook: Ch.23.1-23.2,24.1-24.3.4,24.3.6-24.3.9

Module-5 **8 Hours**

Introduction to Application Layer: Introduction, Client-Server Programming, Standard Client- Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), TELNET, Secure Shell (SSH)

Textbook: Ch.25.1-25.2,26.1-26.6

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1.	Implement three nodes point–to–point network with duplex links between them. Set the Queue size, vary the bandwidth, and find the number of packets dropped.
2.	Implement transmission of ping messages/trace route over a network topology consisting of 6 Nodes and find the number of packets dropped due to congestion.
3.	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion Window for different source/destination.
4.	Develop a program for error detecting code using CRC.
5.	Develop a program to implement a sliding window protocol in the data link layer.
6.	Develop a program to find the shortest path between vertices using the Distance Vector Algorithm (Bellman-Ford).
7.	Develop a program to find the shortest path between vertices using the Link State Algorithm (Dijkstra).
8.	Using TCP/IP sockets, write a client–server program to make the clients end the file name And to make the server send back the contents of the requested file if present.
9	Develop a program on a datagram socket for client/server to display the messages on client side, type dat the server side.
10.	Develop a program for congestion control using a leaky bucket algorithm

Note: For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files. Plot necessary graphs and conclude using NS2 or NS3. Installation procedure of the required software must be demonstrated, carried out in groups, and documented in the report. Non simulation programs can be implemented using Java.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand, analyze, and explain the fundamental principles to interpret basic networking scenarios and select appropriate communication technologies. (PO-1,2,3,5,6,9,11. PSO-1,2,3)

CO2: Apply data link layer principles and protocols to analyze framing, flow control, error control, and medium access mechanisms for reliable point-to-point and shared-channel communication. (PO-1,2,3,5,6,9,11. PSO-1,2,3)

CO3: Apply network layer principles and routing protocols to analyze IP addressing, packet forwarding, and routing mechanisms for efficient data communication across networks. (PO-1,2,3,5,6,9,11. PSO-1,2,3)

CO4: Apply transport layer principles and protocols to analyze process-to-process communication, and evaluate the services, features, and mechanisms of UDP and TCP for reliable end-to-end data transmission. (PO-1,2,3,5,6,9,11. PSO-1,2,3)

CO5: Analyze the working of common application layer protocols and implement basic client–server programming for network-based applications. (PO-1,2,3,5,6,9,11. PSO-1,2,3)

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.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

- The laboratory test after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Behrouz A. Forouzan, Data Communications and Networking,5th Edition, Tata McGraw-Hill,2013.

Reference Books:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks–A Systems Approach,4th Edition, Elsevier, 2019.
2. Nader F. Mir: Computer and Communication Networks,2nd Edition, Pearson Education, 2015.

William Stallings, Data and Computer Communication ,10th Edition, Pearson Education, Inc.,2014.

Web links and Video Lectures(e-Resources):

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. http://www.digimat.in/nptel/courses/video/106105081/L25.html
3. https://nptel.ac.in/courses/10610

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Case Study
- Programming Assignment
- Gate Based Aptitude Test

WEB DEVELOPMENT LAB			
Course Code	25CSL54	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	20	**Exam Hours**	3
Examination type (SEE)	Practical		

Course Objectives:

- Learn HTML 5 elements and their use.
- Use of CSS for enhanced user interface presentation.
- Gain knowledge of JavaScript, AJAX and jQuery for dynamic presentation.
- Use of PHP to build Web applications.
- Design and develop Websites and Web applications.

Sl. No.	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 (<b>, <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 get JSON () method in jQuery d. Illustrate the use of parseJSON() method to display JSON values.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Design the experiment for the given problem using HTML, JavaScript and CSS. (PO-1,2,3,4,5,9,10 PSO-1,2)
- Develop the solution for the given real-world problem using jQuery, Ajax and PHP. (PO-1,2,3,4,5,9,10,11 PSO-1,2)
- Analyze the results and produce substantial written documentation. (PO-1,2,3,4,5,8,9,10 PSO-1,2)

Programming Assignment (5 marks):

Construct a website (multiple Web pages) containing ‘Resume’ and Bio -data by using relevant HTML elements and appropriate styling for presentation with CSS/jQuery/JavaScript. Host the Website on a cloud platform.

Programming Assignment (5 marks):

Build a Web application with HTML, CSS, JavaScript, jQuery and PHP for online application/registration form. Form should accept the information and print/display on a browser with formatting/styling upon submission (Button click) on success. Host the application on a cloud platform.

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 (CIE):

CIE marks for the practical course are **50 Marks.**

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

● Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.

● Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

● Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).

● Weightage to be given for neatness and submission of record/write-up on time.

● Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.

● In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

● The suitable rubrics can be designed to evaluate each student's performance and learning ability.

● The marks scored shall be scaled down to **20 marks** (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

● SEE marks for the practical course are 50 Marks.

● SEE shall be conducted jointly by the two examiners of the same institute; examiners are appointed by the Head of the Institute.

● The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.

All laboratory experiments are to be included for practical examination.

● (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

● Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

● Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, 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 (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours

Suggested Learning Resources:

Books:

1. Randy Connolly and Ricardo Hoar, Fundamentals of Web Development, 3rd edition, Pearson, 2021
2. Robert W Sebesta, Programming the World Wide Web, 8th Edition, Pearson Education, 2020.

Web links:

- https://www.w3schools.com/html/default.asp
- https://www.w3schools.com/css/default.asp
- https://www.w3schools.com/js/js_examples.asp
- https://www.geeksforgeeks.org/javascript-examples/
- https://www.w3schools.com/php/default.asp
- https://www.w3schools.com/jquery/default.asp
- https://www.w3schools.com/js/js_ajax_intro.asp
- https://www.geeksforgeeks.org/jquery-tutorial/

FULL STACK DEVELOPMENT			
Course Code	24CS551	**CIE Marks**	50
Teaching Hours/Week (L: T:P:S)	4:0:0:0	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- Basic knowledge of computer fundamentals
- Understanding of programming concepts (any one language)
- Familiarity with internet usage and web browsers
- Basic understanding of data structures is desirable but not mandatory

Course Objectives:

- To provide students with a strong foundation in front-end, back-end, and database technologies used in full stack web development.
- To enable learners to design responsive and user-friendly web interfaces using modern UI frameworks and scripting languages.
- To develop skills for building secure, scalable, and efficient server-side applications and RESTful APIs.
- To familiarize students with database design, integration, and management using SQL and NoSQL technologies.
- To expose learners to version control, deployment practices, and industry-standard development tools for real-world application development.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.

7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1	10 Hours

Introduction to FSD and Basics Web Technologies

Intro to Fullstack– What is Frontend? – What is the backend? – Roles & Responsibility for Full Stack Developer

Environment Setup: Introduction to HTML & CSS– Basic elements,

Selectors Advanced CSS techniques: flexbox and grid

Textbook-1-Chapter -1,16

Textbook-2- Chapter 1,2,3

Module-2	10 Hours

Basic JavaScript Instructions: Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops.

Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes, Events, Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners

Text Book 3: Chapter 2, 3, 4, 5,6,13

Module-3	10 Hours

Form enhancement and validation. Introduction to MERN: MERN components, Server less Hello world.

React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

Text Book 4: Chapter 1, 2, 3

Module-4	10 Hours

React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components.

Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.

Text Book 4: Chapter 4, 5

Module-5 **10 Hours**

MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, reading from MongoDB, Writing to MongoDB.

Modularization and Webpack, Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle, Hot Module Replacement, Debugging Define Plugin: Build Configuration, Production Optimization.

Text Book 4: Chapter 6, 7

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1:. Understand the fundamentals of Full Stack Development and web technologies including HTML, CSS, and modern layout techniques. (PO -1,2,3,5,11 PSO -1,2)

CO2: Apply JavaScript programming concepts to develop dynamic and interactive web applications using DOM manipulation and event handling. (PO–1,2,3,5,11 PSO -1,2)

CO3: Design and implement frontend applications using React components and form validation techniques. (PO–1,2,3,5,11 PSO -1,2)

CO4: Develop backend services using Express, REST APIs, and GraphQL for efficient client–server communication. (PO–1,2,3,5,9,10,11 PSO -1,2,3)

CO5: Build and integrate database-driven applications using MongoDB and apply modern build tools like Webpack for optimization. (PO–1,2,3,5,11 PSO -1,2,3)

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.

CIE for the theory component of the IPCC (maximum marks 50)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. **Jennifer Niederst Robbins**, *Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics*, O'Reilly Media, 5th Edition.
2. **Robert W. Sebesta**, *Programming the World Wide Web*, Pearson, 7th Edition
3. **Jon Duckett,** "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
4. **Vasan Subramanian**, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019

Web links and Video Lectures(e-Resources):

- https://github.com/vasansr/pro-mern-stack
- https://nptel.ac.in/courses/106106156
- https://archive.nptel.ac.in/courses/106/105/106105084/

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Course Project: Build Web applications using MERN stack. Students (group of 2) can choose any realworld problem from domains such as finance, marketing, medical, or enterprise projects **(15 marks)**.
- Quiz, Online Certification, any related **(10 Marks)**

CLOUD FOUNDATIONS AND PRACTITIONER		Semester	V
Course Code	24CS552	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	
Examination type (SEE)	Theory		

Course objectives:

- Introduce the rationale behind the cloud computing revolution and the business drivers
- Understand various models, types and challenges of cloud computing
- Understand the design of cloud native applications, the necessary tools and the design tradeoffs.
- Realize the importance of Cloud Virtualization, Abstraction`s, Enabling Technologies and cloud security

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
6. Use any of these methods: Chalk and board, Active Learning, Case Studies.

Module-1

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.

Textbook 1: Chapter 1: 1.1 to 1.5

Module-2

Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation

Textbook 1: Chapter 3: 3.1 to 3.5

Module-3

Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure.

Textbook 1: Chapter 4: 4.1 to 4.4

Module-4

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.

Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.

Textbook 2: Chapter 11: 11.1 to 11.3, 11.5 to 11.8, 11.10 to 11.13

Textbook 1: Chapter 4: 4.6

Module-5

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.

Textbook 1: Chapter 6: 6.1 to 6.5

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Describe various cloud computing platforms and service providers.
2. Illustrate the significance of various types of virtualizations.
3. Identify the architecture, delivery models and industrial platforms for cloud computing-based applications.
4. Analyze the role of security aspects in cloud computing.
5. Demonstrate cloud applications in various fields using suitable cloud platforms.

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:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

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

Reference 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. John Rhoton, Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, 2nd Edition, 2009.

Web links and Video Lectures (e-Resources):

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

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Installation of virtualization software (Virtual box, Xen etc..) and run applications with different OS. 10 Marks
- Implement cloud applications using GAE, AWS, Azure/simulate cloud applications using Cloud Sim/ Green cloud/ Cloud Analyst etc.… - 15 Marks

EEP LEARNING			
Course Code	24CS553	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	4:0:0	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- Deep Learning concepts.
- Deep Learning Techniques
- Deep Learning Algorithms

Course Objectives:

- Introduce major deep neural network frameworks and issues in basic neural networks
- To solve real-world applications using Deep learning
- Providing insight into recent Deep Learning architectures

Course Outcomes:

At the end of this course, students will be able to:

1. Understand the methods and terminologies involved in deep neural network, differentiate the learning methods used in Deep-nets.
2. Identify and improve Hyper parameters for better Deep Network Performance
3. To understand and visualize Convolutional Neural Network for real-world applications
4. To demonstrate the use of Recurrent Neural Networks and Transformer based for language modeling

To distinguish different types of Advanced Neural Networks

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different logic and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1	**8 Hours**
NEURAL NETWORKS: The Neuron –Expressing Linear Perceptrons as Neurons – Feed-Forward Neural Networks – Linear Neurons and their Limitations – Sigmoid, Tanh and Relu Functions – Softmax Output LayerS.	
Module-2	**8 Hours**
NEURAL LEARNING: Measuring Errors - Gradient Descent – Delta Rule and Learning Rate – Backpropagation – Stochastic and Minibatch Gradient – Test Sets, Validation Sets and Overfitting – Preventing Overfitting in Deep Neural Networks – Other Optimization Algorithms: Adagrad, RMSProp, Adadelta, Adam	
Module-3	**8 Hours**
CNN & PRETRAINED MODELS: Neurons in Human Vision – Shortcomings of Feature Selection –Scaling Problem in Vanilla Deep Neural Networks – Filters and Feature Maps – Description of Convolutional Layer – Maxpooling – Convolution Network Architecture – Image Classification Self-Supervised Pretraining, AlexNet, VGG, NiN, GoogleNet, Residual Network (ResNet), DenseNet, Region-Based CNNs (R-CNNs) – Transfer Learning - FSL	
Module-4	**8 Hours**
RECURRENT NEURAL NETWORKS: Sequence-to-Sequence Modeling – Embedding - Recurrent Neural Networks - Bidirectional RNNs, Analyzing Variable Length Inputs – Tackling seq2seq Problem – Beam Search and Global Normalization – Recurrent Neural Networks (RNN)– Hidden States – Perplexity – Character-level Language Models –Modern RNNs: Gated Recurrent Units (GRU), Long Short- T e r m Memory (LSTM), Bidirectional Long Short Term Memory (BLSTM), Deep Recurrent Neural Network, Bidirectional RNN	
Module-5	**8 Hours**
5ADVANCE NEURAL NETWORKS:Attention Mechanism: Attention Cues, Attention Pooling, Scoring Functions, Self-Attention and Positional Encoding;–Bidirectional Encoder Representations from Transformers (BERT) – Generative Pre-trained Transformers Generative Adversarial Networks – Generator, Discriminator, Training, GAN variants; Autoencoder: Architecture, Denoising and Sparcity; DALL-E, DALL-E 2 and IMAGEN	

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.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Text Book(s)	
1.	Fundamentals of Deep Learning, Nikhil Buduma and Nicholas Locasio, O-Reilly, 2022 2nd Edition
2.	Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, Amazon Senior Scientists – Open source and Free Book, March 2022
Reference Books	
1.	Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2024
2.	Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2024

Web links and Video Lectures(e-Resources):

- https://www.cse.iitm.ac.in/~miteshk/CS6910.html

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test

DATA ENGINEERING AND MLOps			
Course Code	24CS554	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	4:0:0	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- Basic knowledge of programming concepts (Python preferred)
- Fundamental understanding of data structures and algorithms
- Basic concepts of databases and SQL
- Introductory knowledge of machine learning concepts
- Familiarity with software engineering fundamentals

Course Objectives:

- To introduce the concepts and lifecycle of Data Engineering.
- To explore principles of data architecture and distributed systems.
- To familiarize students with MLOps pipelines for scalable ML solutions.
- To understand model deployment, CI/CD, monitoring, and feedback loops.
- To ensure governance, reproducibility, and responsible AI compliance.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching
methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Use any of these methods: Chalk and board, Active Learning, Case Studies

Module-1	10 Hours
Data Engineering: Definition, The Data Engineering Lifecycle, Evolution of the Data Engineer, Data Engineering and Data Science, Data Engineering Skills and Activities, Data Maturity and the Data Engineer, The Background and Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers Inside an Organization, Data Engineers and Other Technical Roles. **Data Engineering Lifecycle:** The Data Lifecycle Versus the Data Engineering Lifecycle, Generation: Source Systems, Major Undercurrents Across the Data Engineering Lifecycle. Textbook 1: Chapter 1 (1.1-1.3), Chapter 2 (2.1-2.2)	
Module-2	**10 Hours**
Data Architecture: What is Data Architecure?: Enterprise Architecture Defined, Data Architecture Defined, "Good" Data Architecture; Principles of Good Data Architecture; Major Architecture Concepts: Domains and Services, Distributed Systems, Scalability, and Designing for Failure, Tight Versus Loose Coupling: Tiers, Monoliths, and Microservices, User Access: Single Versus Multitenant, Event-Driven Architecture; Examples and Types of Data Architecture. **Choosing Technologies Across the Data Engineering Lifecycle:** Team Size and Capabilities, Speed to Market, Interoperability, Today Versus the Future: Immutable Versus Transitory Technologies, Hybrid Cloud, Multicloud, Decentralized: Blockchain and the Edge, Monolith Versus Modular, Serverless Versus Servers: Server Versus Serverless evaluation. **Text book 1: Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.3, 4.5-4.6, 4.8, 4.9)**	
Module-3	**10 Hours**
Why Now and Challenges: Defining MLOps and its Challenges, MLOps to Mitigate Risk, Risk Assessment, Risk Mitigation, MLOps for Responsible AI, MLOps for Scale. **Key MLOps Features**: Model Development, Establishing Business Objectives, Data Sources and Exploratory Data Analysis, Feature Engineering and Selection, Training and Evaluation, Reproducibility, Responsible AI, Productionalization and Deployment, Model Deployment Types and Contents, Model Deployment Requirements, Monitoring. **Developing Models:** Machine Learning Model, Required Components, Different ML Algorithms, Different MLOps Challenges, Data Exploration, Feature Engineering and Selection, Feature Engineering Techniques, How Feature Selection Impacts MLOps Strategy, Experimentation, Evaluating and Comparing Models, Choosing Evaluation Metrics, CrossChecking Model Behavior, Impact of Responsible AI on Modeling, Version Management and Reproducibility Textbook 2: Chapter 1 (1.1- 1.3), Chapter 3 (3.1-3.4) Chapter 4 (4.1–4.6)	
Module-4	**10 Hours**

Preparing for Production: Runtime Environments, Adaptation from Development to Production Environments, Data Access Before Validation and Launch to Production, Final Thoughts on Runtime Environments, Model Risk Evaluation: The Purpose of Model Validation, The Origins of ML Model Risk, Quality Assurance for Machine Learning.

Deploying to Production: CI/CD Pipelines, Building ML Artifacts, The Testing Pipeline, Deployment Strategies, Categories of Model Deployment, Considerations When Sending Models to Production, Maintenance in Production, Containerization, Scaling Deployments, Requirements and Challenges.

Textbook 2: Chapter 5 (5.1–5.4), Chapter 6 (6.1–6.6)

Module-5 **10 Hours**

Monitoring and Feedback Loop: Models Be Retrained, Understanding Model Degradation, Ground Truth Evaluation, Input Drift Detection, Drift Detection in Practice, Example Causes of Data Drift, Input Drift Detection Techniques, The Feedback Loop, Logging, Model Evaluation, Online Evaluation.

Model Governance: Governance the Organization Needs, Matching Governance with Risk Level, Current Regulations Driving MLOps Governance, Pharmaceutical Regulation in the US: GxP Financial Model Risk Management Regulation, GDPR and CCPA Data Privacy Regulations, The New Wave of AI-Specific Regulation, The Emergence of Responsible AI, Key Elements of Responsible AI (Element 1 to Element 5), A Template for MLOps Governance (Step 1 to 8).

Textbook 2: Chapter 7 (7.1–7.4), Chapter 8

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

CO1: Explain Data Engineering and various roles. (PO –1, 2 PSO – 1)
CO2: Analyze various major architecture concepts of Data engineering. (PO – 1, 2, 3 PSO –1)
CO3: Apply MLOps Features and analyze the challenges in developing and Deploying Machine Learning Models**.** (PO – 1, 2, 3, 5 PSO –1, 2)
CO4: Design CI/CD Pipelines for Deploying Machine Learning Models. (PO –1, 2, 3, 5 PSO –1, 2, 3)
CO5: Explain the need for model governance and MLOps governance. (PO – 1, 2, 6 PSO –1, 2, 3)

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.

CIE for the theory component of the IPCC (maximum marks 50)

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbooks:

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly, 2022
2. Mark Treveil & Dataiku Team, Introducing MLOps, O'Reilly, 2020

Web links and Video Lectures(e-Resources):

- https://www.ibm.com/think/topics/data-engineering
- https://martinfowler.com/articles/microservices.html
- https://www.coursera.org/specializations/mlops

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Assignment 1 (15 marks) : Select a simple machine learning use case (e.g., house price prediction, customer churn prediction, or fraud detection). Design an MLOps pipeline that includes
  a. Problem statement and business objective
  b. Data sources and exploratory data analysis summary
  c. Feature engineering and selection approach
  d. Model training and evaluation plan
  e. Reproducibility and version control strategy Draw a flowchart or block diagram representing the MLOps pipeline
- Assignment 2(10 marks): Choose any one open-source MLOps tool (like MLflow, Kubeflow, or TFX). Study how the tool supports
  a. CI/CD pipelines
  b. Model testing & validation
  c. Deployment strategies.

Write a report on tool overview and core components, CI/CD support, One deployment strategy explained in context, Advantages & challenges of using this tool in a real project.

ADVANCED UI AND UX DESIGN

Course Code	**24CS561**	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	3: 0 : 2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40 Theory + 10 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on:

- **Design Principles:** Understanding of color theory, typography, visual hierarchy, and layout.
- **User-Centered Design (UCD):** A strong focus on user needs, behaviors, and pain points.
- **Empathy:** The ability to understand the user's perspective and needs.
- **Prototyping & Wireframing:** Ability to create low-fidelity and high-fidelity wireframes, interactive prototypes, and user flows.
- **Basic Technical Knowledge:** Familiarity with **HTML**, **CSS**, and occasionally JavaScript is a major plus.

Course Objectives: To impart Knowledge on the following topics:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

Teaching-Learning Process (General Instructions):

1. Chalk and Talk with Black Board.
2. ICT based Teaching.
3. Demonstration based Teaching.

Module-1 **8 Hours**

FOUNDATIONS OF DESIGN: UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

Textbook: Text Book 1 and 2

Module-2	8 Hours
FOUNDATIONS OF UI DESIGN: Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides. **Textbook: Text Book 1 and 2**	
Module-3	**8 Hours**
FOUNDATIONS OF UX DESIGN: Introduction to User Experience - Why You Should Care about User Experience -Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals. **Textbook: Text Book 1 and 2**	
Module-4	**8 Hours**
WIREFRAMING, PROTOTYPING AND TESTING: Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing -Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration. **Textbook: Text Book 1 and 2**	
Module-5	**8 Hours**
RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE: Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories – Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture. **Textbook: Text Book 1 and 2**	
Course Outcomes (Course Skill Set): On completion of the course, the students will be able to: **CO1:** Understand the various Research Methods used in Design. (PO – 1, 3, 8, 9, 10 PSO –1, 2) **CO2:** Build UI for user Applications. (PO – 1, 2, 3, 8, 9, 10 PSO –1, 2) **CO3:** Evaluate UX design of any product or application. (PO – 1, 2, 3, 8, 9, 10 PSO –1, 2, 3) **CO4:** Demonstrate UX Skills in product development. (PO – 1, 2, 3, 8, 9, 10 PSO –1, 2, 3) **CO5:** Implement Sketching principles, Create Wireframe and Prototype. (PO – 1, 2, 3, 8, 9, 10 PSO –1, 2, 3)	

Practical Component of IPCC:

Sl. No.	Experiment
1	Design a homepage for an online shopping website with a navigation bar, a hero banner with a headline and Call to Action button, a product grid displaying image, name, price and discount badge.
2	Create a professional promotional banner/poster for a college event or product launch or sale campaign or awareness program using Figma.
3	Design a mobile login flow for a food delivery app with an email and password input, a "Forgot Password" link, a primary sign-in button and a success screen that navigates to the home feed after login.
4	Design a Profile setting page with sections for avatar upload, personal info form fields, notification toggle switches and a save button.
5	Design an order tracking screen for a food delivery app with 4 live statuses (Order Placed, Preparing, Out for Delivery, Delivered) controlled by interactive status step indicators.
6	Design a full screen story viewer for a social app with 3 story frames, tap-left/tap-right gesture for navigation, a progress bar that advances and a reply input that slides up.
7	Design a desktop video lesson player with a collapsible sidebar course list and a video player area with play/pause hover controls.
8	Design a desktop travel explore screen with a hero banner and a horizontally scrollable(sideways) destination image carousel.
9	Design a dark mode toggle for a settings page were tapping the toggle switch transitions the entire screen between a light mode and dark mode version using Smart Animate.
10	Design a restaurant menu screen for a food delivery app where tapping a menu item opens an item detail overlay with image, description, quantity stepper, and an "Add to Cart" button that returns to the menu.

Assessment Details (both CIE and SEE):

CIE for the Theory component of the IPCC (Maximum Marks 25)

25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

CIE for the Practical component of the IPCC (Maximum Marks 25)

- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination (SEE) of IPCC (100 Marks scaled down to 50 marks):

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

TEXT BOOKS:

1. Joel Marsh —UX for Beginners, O 'Reilly, 2022.
2. Jon Yablonski —Laws of UX using Psychology to Design Better Product & Services, O 'Reilly, 2021.

REFERENCES:

1. Jenifer Tidwell, Charles Brewer and Anne Valencia —Designing Interface, 3rd Edition, O'Reilly 2020
2. Steve Schoger and Adam Wathan —Refactoring UI, 2018.

3. Steve Krug —Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile, Third Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

Web links and Video Lectures(e-Resources):

1. https://www.youtube.com/playlist?list=PLjiHFwhbHYlHSpAflJwjsKAyMaMhASm0F
2. https://certifiedprofessional.adobe.com/en/resources/web-design/web-design-certification/how-to-become-a-ui-ux-designer
3. https://www.coursera.org/learn/fundamentals-of-uiux-design
4. https://blush.design/blog/post/guide-ui-design
5. https://www.figma.com/resource-library/design-basics/
6. https://www.udemy.com/course/user-experience-design-user-interface-design-fundamentals/?srsltid=AfmBOooiTU59v4mAgoTycZn631EUfbnKV8KA-dQ2Y3wmmPzpWYThn4Lh

Activity Based Learning (Suggested Activities in Class):

- Students are expected to prepare animated PPT to illustrate the different types of User Interfaces.
- Students are required to prepare detailed case study report on User Experience by different platforms such as Websites and Mobile devices.

AI Cloud Practitioner			
Course Code	**24CS562**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**3:0:2:0**	**SEE Marks**	**50**
Credits	**4**	**Total Marks**	**100**
Contact Hours	**40 Theory + 10 Practical**	**Exam Hours**	**3**
Examination type (SEE)	**Theory / Practical**		

Prerequisites:

The students should have knowledge on:

- Basic understanding of cloud computing concepts and service models (IaaS, PaaS, SaaS).
- Fundamental knowledge of Artificial Intelligence and Machine Learning concepts.
- Familiarity with Python programming and basic data handling.
- Awareness of web applications, APIs, and virtualization concepts.
- Understanding of Linux commands and basic networking concepts.

Course Objectives:

CO1: Understand AI services offered by major cloud platforms (AWS, Azure, GCP).

CO2: Learn how to deploy, consume, and manage AI services in cloud environments.

CO3: Apply AI APIs for vision, speech, NLP, and recommendation systems.

CO4: Understand ethical, security, privacy, and governance issues in AI cloud systems.

CO5: Build foundational skills required for AI cloud practitioner and associate-level certifications.

Teaching-Learning Process (General Instructions)

- Blended learning with lectures, demos, case studies, and cloud labs.
- Activity-Based Learning (ABL): hands-on AI API usage, mini case studies.
- Use of architecture diagrams, cloud dashboards, and workflows.
- Exposure to AWS, Azure, and Google Cloud AI free-tier tools.
- Students encouraged to explore cloud documentation and certification paths

Module-1 **8 Hours**

Module 1: Foundations of AI in Cloud

Introduction to AI & ML in Cloud, Evolution of Cloud-based AI Services, AI-as-a-Service (AIaaS), Cloud AI Architecture Overview, AI Workloads on Cloud, Use cases of AI Cloud in Healthcare, Agriculture, Finance, Smart Cities, Cloud Deployment Models for AI, Cost Models and Pricing.

Text Book: Chapter 1, 2

Module-2	8 Hours

Module 2: AI Services & APIs in Cloud Platforms

Overview of AWS AI Services (Recognition, Polly, Lex, Comprehend, SageMaker – intro),AZURE Cognitive Services (Vision, Speech, Language, Decision), Google Cloud AI (Vision API, Speech-to-Text, Natural Language API, Vertex AI – intro), Consuming AI APIs, Authentication, API Workflows, Cloud SDKs, Demo Workflows.

Text Book: Chapter 3, 4

Module-3	8 Hours

Module 3: Data, MLOps & AI Model Deployment

Cloud Data Pipelines for AI, Data Storage Options (Object, NoSQL, SQL),ML Lifecycle in Cloud (Train, Validate, Deploy, Monitor), Introduction to MLOps, CI/CD for ML, Model Hosting, Versioning, Inference APIs, Monitoring Model Performance, Drift Detection, Scaling AI Services.

Text Book: Chapter 5, 6

Module-4	8 Hours

Module 4: Security, Privacy, Ethics & Governance in AI Cloud

Shared Responsibility Model for AI Services, Data Privacy & Compliance (GDPR, HIPAA – overview), AI Ethics, Bias in AI Models, Explainable AI (XAI – basics), Secure API Access, IAM for AI Services, Encryption, Auditing AI Pipelines.

Text Book: Chapter 7

Module-5	8 Hours

Module 5: AI Cloud Architecture Patterns & Case Studies

Reference Architectures for AI Applications, End-to-End AI Cloud Pipeline Design, Real-world Case Studies (Chatbots, Smart Surveillance, Crop Disease Detection, Voice Assistants), Cost Optimization for AI Workloads, Cloud AI Certification Roadmap (AWS AI Practitioner, Azure AI-900, Google Cloud AI Engineer – overview).

Text Book: Chapter 8, 9

PRACTICAL COMPONENTS OF IPCC

Sl .No.	Experiments
1.	**Build a web app that detects faces and emotions from an uploaded image using a cloud vision API (free tier).** *Outcome:* User uploads an image → system returns number of faces + emotion labels. *Tools:* Google Vision API / HuggingFace Spaces.
2.	**Implement OCR to extract text from scanned documents using a cloud AI service and display it in a web UI.** *Outcome:* Upload image/PDF → extracted text shown + downloadable text file. *Tools:* Azure Computer Vision (free tier) / Tesseract + Colab.
3.	**Develop a speech-to-text application that converts recorded audio into text using a cloud speech API.** *Outcome:* Record voice → transcribed text shown in browser. *Tools:* Google Speech-to-Text (free tier).
4.	**Create a text-to-speech service that converts user-entered text into natural-sounding speech and plays it in the browser.** *Outcome:* Text → MP3 audio output. *Tools:* AWS Polly (free tier).
5.	**Build a sentiment analysis system that classifies user reviews as Positive, Negative, or Neutral using a cloud NLP API.** *Outcome:* Input review → sentiment label + confidence score. *Tools:* Azure Text Analytics / HuggingFace Inference API.
6.	**Design a FAQ chatbot for a college website using a cloud conversational AI platform.** *Outcome:* Chat interface answers predefined college FAQs. *Tools:* Google Dialogflow (free tier).
7.	**Implement an image classification system that identifies objects in user-uploaded images using a pre-trained cloud AI model.** *Outcome:* Upload image → top-3 predicted labels with confidence. *Tools:* AWS Rekognition / HuggingFace Vision models.
8.	**Train a simple image classifier using AutoML on a cloud platform and evaluate its accuracy.**

	Outcome: Dataset upload → trained model → accuracy report. *Tools:* Google AutoML (free credits) / Teachable Machine.
9.	**Deploy a trained ML model as a REST API and expose an inference endpoint accessible over the internet.** *Outcome:* POST request → JSON prediction response. *Tools:*HuggingFace Spaces + FastAPI.
10.	**Implement logging and monitoring for AI inference requests and visualize request count and errors.** *Outcome:* Dashboard showing number of API calls + failures. *Tools:*MLflow / simple logging + Streamlit dashboard.
11.	**Secure an AI API endpoint using cloud IAM / API keys and demonstrate authorized vs unauthorized access.** *Outcome:* Valid key works; invalid key is rejected. *Tools:* Azure API keys / FastAPI token auth.
12.	**Develop a mini AI cloud application for crop disease detection using a pre-trained vision model and deploy it online.** *Outcome:* Upload leaf image → disease class + confidence. *Tools:* Google Colab + TensorFlow Hub + HuggingFace Spaces.

Course Outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1. **CO1:** Explain AI cloud concepts, AIaaS models, and real-world applications of AI in cloud platforms.
   (PO – 1,2,5,11 | PSO – 1,2,3)
2. **CO2:** Apply AI cloud services and APIs to build basic intelligent applications. (PO – 1,2,3,4,5,11| PSO – 1,2,3)
3. **CO3:** Analyze cloud-based ML pipelines and deploy AI models using MLOps principles. (PO – 1,2,3,4,5,11| PSO – 1,2,3)
4. **CO4:** Evaluate security, privacy, ethical, and governance issues in AI cloud systems. (PO – 1,2,3,4,6,8,11 | PSO – 1,2,3)
5. **CO5:** Design scalable and cost-effective AI cloud architectures for real-world applications. (PO – 1,2,3,4,5,11| PSO – 1,2,3)

Assessment Details (both CIE and SEE):

CIE for the theory component of the IPCC (maximum marks 50)

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

CIE for the practical component of the IPCC

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. **M**astering Cloud Computing, Rajkumar Buyya, 2nd edition, 2024
2. Hands-On Machine Learning on Google Cloud Platform – Packt, 1st edition, April 2018
3. Designing Machine Learning Systems – Chip Huyen, Grayscale Indian edition, 2022

References:

1. Artificial Intelligence: A Modern Approach, 2nd edition, 2019
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, 2nd edition, 2019

Web links and Video Lectures(e-Resources):

E- resources:

1. **Cloud Computing Tutorial (GeeksforGeeks)** – Beginner-friendly explanation of cloud computing basics like service models (IaaS, PaaS, SaaS), deployment models, virtualization and more, perfect for Modules 1 & 3. Cloud Computing Tutorial – GeeksforGeeks
2. **AI for Beginners (Microsoft GitHub)** – A structured curriculum to learn foundational AI concepts including ML basics, ethical AI, and real-world applications (Modules 2 & 5). AI for Beginners – Microsoft GitHub
3. **Great Learning Free AI Courses** – Free online courses covering essential AI topics like ML,

NLP, and computer vision, useful across Modules 2, 4 & 5. Free AI Courses – Great Learning

Video Lectures:

1. https://www.youtube.com/live/TZd_RDJIezo — Cloud Computing Full Course (Fundamentals, Service Models, AWS/Azure comparison)
2. https://www.youtube.com/watch?v=EN4fEbcFZ_E — Cloud Computing Full Course for Beginners (AWS, Azure, GCP basics)
3. https://www.classcentral.com/course/youtube-cloud-service-providers-aws-vs-microsoft-azure-vs-gcp-which-is-best-105674 — AWS vs Azure vs GCP video (cloud providers comparison)

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- AssessmentMethodsfor25 Marks (opt two Learning Activities)
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test

Suggested Activity Statement:

Activity: Students will implement a mini-project by deploying a pre-trained AI model on a cloud platform, perform predictions on sample data, and present their findings, demonstrating practical understanding of AI services and cloud integration.

Natural Language Processing			
Course Code	24CS563	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 hrs. + 10 hrs. lab	**Exam Hours**	3
Examination nature (SEE)	Theory		

Course objectives:

This course will enable students to,

- Learn the importance of natural language modeling
- Understand the applications of natural language processing
- Study spelling, error detection and correction methods and parsing techniques in NLP
- Illustrate the information retrieval models in natural language processing

Teaching-Learning Process (General Instructions)

These are sample strategies that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not be only traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of video/animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) learning in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develops design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

MODULE-1 **08 Hours**

Introduction & Language Modeling: What is Natural Language Processing? Origins of NLP, Language and Knowledge, the Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications. Language Modeling: Statistical Language Model – *n-gram models* (unigram, bigram), Paninian Framework, Karaka theory.

Textbook 1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2

MODULE-2	08 Hours

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging.

Syntactic Analysis: Context-Free Grammar, Constituency, Top-down and Bottom-up Parsing, CYK Parsing.

Textbook 1: Chapter 3, Chapter 4.

MODULE-3	08 Hours

Naive Bayes, Text Classification and Sentiment: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.

Textbook 2: Chapter 4.

MODULE-4	08 Hours

Information Retrieval: Design Features of Information Retrieval Systems, Information Retrieval Models – Classical, Non-classical, Alternative Models of Information Retrieval – Customer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval.

Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.

Textbook 1: Chapter 9, Chapter 12.

MODULE-5	8 Hours

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.

Textbook 2: Chapter 13.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Programs
1	Write a Python program for the following preprocessing of text in NLP: ● Tokenization ● Filtration ● Script Validation ● Stop Word Removal ● Stemming
	●

2	Demonstrate the N-gram modeling to analyze and establish the probability distribution across sentences, and explore the utilization of unigrams, bigrams, and trigrams in diverse English sentences to illustrate the impact of varying N-gram orders on the calculated probabilities.
3	Investigate the Minimum Edit Distance (MED) algorithm and its application in string comparison. The goal is to understand how the algorithm efficiently computes the minimum number of edit operations required to transform one string into another. ● Test the algorithm on strings with different types of variations (e.g., typos, substitutions, insertions, deletions). ● Evaluate its adaptability to different types of input variations.
4	Write a program to implement top-down and bottom-up parser using appropriate context-free grammar.
5	Given the following short movie reviews, each labeled with a genre, either comedy or action: ● fun, couple, love, love — comedy ● fast, furious, shoot — action ● couple, fly, fast, fun, fun — comedy ● furious, shoot, shoot, fun — action ● fly, fast, shoot, love — action A new document D**:** fast, couple, shoot, fly
6	Demonstrate the following using appropriate programming tool which illustrates the use of information retrieval in NLP: ● Study the various corpora – Brown, Inaugural, Reuters, UDHR with various methods like fileids, raw, words, sents, categories. ● Create and use your own corpora (plain text, categorical). ● Study Conditional Frequency Distributions. ● Study of tagged corpora with methods like tagged_sents, tagged words. ● Write a program to find the most frequent noun tags. ● Map Words to Properties using Python Dictionaries. ● Study Rule-based Tagger, Unigram Tagger. Find different words from a given plain text without any spaces by comparing this text with a given corpus of words. Also, find the score of words.
7	Write a Python program to find synonyms and antonyms of the word "active" using WordNet.
8	Implement the machine translation application of NLP where it needs to train a machine translation model for a language with limited parallel corpora. Investigate and incorporate techniques to improve performance in low-resource scenarios.

Course outcome (Course Skill Set):

At the end of the course, the student will be able to:

● Apply the fundamental concept of NLP, grammar-based language model and statistical-based language model. (POs: PO1, PO2, PO3)

● Model morphological analysis using Finite State Transducers and parsing using context-free grammar and different parsing approaches. (POs: PO1, PO2, PO4)

● Develop the Naïve Bayes classifier and sentiment analysis for natural language problems and text classifications. (POs: PO2, PO3, PO5, PO11)

● Apply the concepts of information retrieval, lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, distributional word similarity. (POs: PO1, PO2, PO4, PO7)

● Identify the Machine Translation applications of NLP using Encoder and Decoder. (POs: PO2, PO3, PO5, PO11)

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, the 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:

• IPCC means practical portion integrated with the theory of the course.

● CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.

● 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (two tests, each of 15 marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods. The first test is at the end of 40–50% coverage of the syllabus and the second test after covering 85–90% of the syllabus.

● Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks

for the theory component of IPCC (that is, for 25 marks).

● The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

● 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.

● On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.

● The CIE marks awarded in the case of the practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

● The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.

● Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.

● The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions) should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the students shall be proportionally scaled down to 50 marks.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources

Textbooks:

1. Tanveer Siddiqui, U.S. Tiwary, *Natural Language Processing and Information Retrieval*, Oxford University Press.
2. Daniel Jurafsky, James H. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*, Pearson Education, 2023.

Reference Books:

1. Akshay Kulkarni, Adarsha Shivananda, *Natural Language Processing Recipes – Unlocking Text Data with Machine Learning and Deep Learning using Python*, Après, 2019.
2. TV Geetha, *Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives*, Pearson, 2024.
3. Gerald J. Kowalski and Mark T. Maybury, *Information Storage and Retrieval Systems*, Kluwer Academic Publishers.

Web links and Video Lectures (e-Resources):

Here are the direct links:

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://youtu.be/02QWRAhGc7g
3. https://www.youtube.com/watch?v=CMrHM8a3hqw
4. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
   https://archive.nptel.ac.in/courses/106/106/106106211/

Activity Based Learning (Suggested Activities in Class)/ Practical Based Learning

Text Classification Game (5 Marks)

● **Objective:** Learn supervised learning and text classification.
● **Activity:** Provide students with a set of documents (e.g., movie reviews) labeled as positive or negative. Divide them into groups and have them create a simple classification model using keywords or phrases. They can then test their model on new reviews.

Grammar Check and Correction (5 Marks)

● **Objective:** Learn about language structure and NLP tools.
● **Activity:** Provide sentences with grammatical errors. Students can use grammar checking tools (like Grammarly or Language Tool) to identify errors and suggest corrections, discussing why each suggestion is made.

Statistical Machine Learning for Data Science			
Course Code	**24CS644**	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	40 Theory + 10 Labs	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- Basic statistics concepts.
- Machine Learning Techniques
- Machine Learning Algorithms

Course Objectives:

- Understand Exploratory Data Analysis
- Explain Data and Sampling Distributions
- To Analyze Statistical experiments and perform significance testing
- To demonstrate how to perform regression analysis on the data
- Explain Discriminant Analysis on the data.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different logic and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1	**8 Hours**
Exploratory Data Analysis: Estimates of locations and variability, exploring data distributions, exploring binary and categorical data, exploring two or more variables. **Text book: Chapter 1**	
Module-2	**8 Hours**
Data and Sampling Distributions: Random sampling and bias, selection bias, sampling distribution of statistic, bootstrap, confidence intervals, data distributions: normal, long tailed, student's-t, binomial, Chi-square, F distribution, Poisson and related distributions. **Text book: Chapter 2**	
Module-3	**8 Hours**
Statistical Experiments and Significance Testing: A/B testing, hypothesis testing, resampling, statistical significance & p-values, t-tests, multiple testing, degrees of freedom. **Text book: Chapter 3**	
Module-4	**8 Hours**
Regression Analysis: Multi-arm bandit algorithm, power and sample size, factor variables in regression, interpreting the regression equation, Regression diagnostics, Polynomial and Spline Regression. **Text book: Chapter 3,4**	
Module-5	**8 Hours**
Discriminant Analysis: Covariance Matrix, Fisher's Linear discriminant, Generalized Linear Models, Interpreting the coefficients and odd ratios, Strategies for Imbalanced Data. **Text book: Chapter 5**	

PRACTICAL COMPONENT OF IPCC

Sl. No.	Programs
1.	A dataset contains the prices of houses in a city. Find the 25th and 75th percentiles and calculate the interquartile range (IQR). How does the IQR help in understanding the price variability?
2.	You are given a dataset with categorical variables about customer satisfaction levels (Low, Medium, High) and whether customers made repeat purchases (Yes/No). Create visualizations such as bar plots or stacked bar charts to explore the relationship between satisfaction level and repeat purchases. What can you infer from the data?
3.	A dataset contains information about car models, including the engine size (in Liters), fuel efficiency (miles per gallon), and car price. Use a pair plot or correlation matrix to explore the relationships between these variables. Which variables seem to have the strongest relationships, and what might be the practical significance of these findings?
4.	You want to estimate the mean salary of software engineers in a country. You take 10 different random samples, each containing 50 engineers, and calculate the sample mean for each. Plot the distribution of these sample means. How does the Central Limit Theorem explain the shape of this sampling distribution, even if the underlying salary distribution is skewed?
5.	A researcher conducts an experiment with a sample of 20 participants to determine if a new drug affects heart rate. The sample has a mean heart rate increase of 8 beats per minute and a standard deviation of 2 beats per minute. Perform a hypothesis test using the t-distribution to determine if the mean heart rate increase is significantly different from zero at the 5% significance level.
6.	A company is testing two versions of a webpage (A and B) to determine which version leads to more sales. Version A was shown to 1,000 users and resulted in 120 sales. Version B was shown to 1,200 users and resulted in 150 sales. Perform an A/B test to determine if there is a statistically significant difference in the conversion rates between the two versions. Use a 5% significance level.
7.	You are comparing the average daily sales between two stores. Store A has a mean daily sales value of $1,000 with a standard deviation of $100 over 30 days, and Store B has a mean daily sales value of $950 with a standard deviation of $120 over 30 days. Conduct a two-sample t-test to determine if there is a

	significant difference between the average sales of the two stores at the 5% significance level.
8.	A company collects data on employees' salaries and records their education level as a categorical variable with three levels: "High School", "Bachelor's", and "Master's". Fit a multiple linear regression model to predict salary using education level (as a factor variable) and years of experience. Interpret the coefficients for the education levels in the regression model.
9	You have data on housing prices and square footage and notice that the relationship between square footage and price is nonlinear. Fit a spline regression model to allow the relationship between square footage and price to change at 2,000 square feet. Explain how spline regression can capture different behaviors of the relationship before and after 2,000 square feet.
10.	A hospital is using a Poisson regression model (a type of GLM) to predict the number of emergency room visits per week based on patient age and medical history. The model is given by: $\text{Log}(\lambda) = 2.5 - 0.03*\text{Age} + 0.5*\text{condition}$ where λ is the expected number of visits per week, **Age** is the patient's age, and **condition** is a binary variable (1 if the patient has a chronic condition, 0 otherwise). Interpret the coefficients of Age and condition. What is the expected number of visits per week for a 60-year-old patient with a chronic condition? How would the expected number of visits change if the patient did not have a chronic condition?

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Understand and apply **Exploratory Data Analysis (EDA)** techniques to summarize, visualize, and interpret real-world datasets.

CO2: Explain and analyze **data distributions and sampling distributions** to model uncertainty and variability in data.

CO3: Analyze **statistical experiments** and perform **hypothesis testing and significance testing** to draw valid inferences from data.

CO4: Design and implement **regression and discriminant analysis models** to identify relationships and

classify data effectively.

CO5: Design and implement **research-oriented, real-world problem solutions using deep learning techniques**, working collaboratively in a team.

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.

CIE for the theory component of the IPCC (maximum marks 50)

● CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
● 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
● Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
● The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.
Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

CIE for the practical component of the IPCC

1. 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
2. On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
3. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks.
4. Marks of all experiments' write- ups are added and scaled down to 15 marks.
5. The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
6. Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
7. The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. Peter Bruce, Andrew Bruce and Peter Gadeck, "Practical Statistics for Data Scientists", 2nd edition, O'Reilly Publications, 2024.

Reference Book:

1. The Elements of Machine Learning

(https://www.sas.upenn.edu/~fdiebold/NoHesitations/BookAdvanced.pdf)

Web links and Video Lectures(e-Resources):

1. Statistical learning for Reliability Analysis: https://nptel.ac.in/courses/106105239
2. Engineering Statistics: https://nptel.ac.in/courses/127101233

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
    - Case Study
    - Programming Assignment
    - Gate Based Aptitude Test

Environmental Studies and E-Waste Management			
Course Code	24EV57	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	1:0:0	**SEE Marks**	50
Credits	0	**Total Marks**	100
Contact Hours	14	**Exam Hours**	1
Examination type (SEE)	Theory		

Course Objectives:

- Identify the major challenges of environmental issues
- Develop skills, critical thinking and demonstrate socio-economic skills for Environmental protection
- Analyze the impact of issues w. r. t. waste management

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes Critical thinking.
5. Adopt Case study Based Learning (CBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1 **8 Hours**

Ecosystem and Sustainability:

Ecosystem: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. Sustainability: 17SDG targets and possible actions.

Self-Study Component (SSC): Components of the environment.

Textbook 1: CH- 3, e-resource: 1

Module-2 **8 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

Self-Study Component (SSC): Alternative Energy sources

Textbook 1: CH- 2

Module-3 **8 Hours**

Environmental Pollution:

Environmental Pollution: Water Pollution, Noise pollution, Air pollution (Sources, Impacts, Preventive measures and Public Health Aspects.

Self-Study Component (SSC): Case studies of air pollution episodes

Textbook 1: CH- 5

Module-4 **8 Hours**

Waste management:

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.

Self-Study Component (SSC): Case studies on waste management options

Textbook 1: CH- 6, e-resource:2

Module-5 **8 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.

Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024

Textbook 1: CH- 6, Textbook 2: CH-2, e-resource:3

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1. Comprehend the principles of ecology and environmental issues pertaining to air, land, and water on a global scale. PO-1,2,3,4,5,6,7,8,9,10,11 PSO-1,2,3
2. Acquire observation skills for solving problems related to the environment. PO-1,2,3,4,5,6,7,8,9,10,11 PSO-1,2,3
3. Conduct survey to describe the realities of waste management system. PO-1,2,3,4,5,6,7,8,9,10,11 PSO-1,2,3

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 Examination (CIE)

• For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.

• The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered

• Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

• For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Semester End Examinations (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.

Suggested Learning Resources:

Textbooks

1. S M Prakash, "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore, 2018. 2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009. Reference Books: 1. Earch Barucha, "Environmental Studies for UG students", 2004.
2. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
3. R. Rajagopalan, "Environmental Studies- From Crisis to Cure", 2nd Edition, Oxford university press, New Delhi, 2013.
4. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
5. Raman Sivakumar, "Principles of Environmental Science and Engineering", 2nd edition, Cengage learning Singapur, 2005.
6. G. Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr. Pratiba Singh, Dr.Anoop Singh and Dr. Piyush Malaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.
8. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006

Web links and Video Lectures(e-Resources):

- https://sdgs.un.org/goals
- https://kspcb.karnataka.gov.in/waste-management/biomedical-waste
- https://kspcb.karnataka.gov.in/waste-management/e-waste

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Analysis report of case study specified in the Textbooks and reference books (one per student). (10 marks)
- Field Survey (In Team): The students' team of the size of 2 to 4 are expected to visit the organization or Industry understand the waste management, utilization of energy, pollution concerns, e-waste handling and other related suggested best practices specified in the syllabus and then submit a detailed visit report to the concerned staff. (15 marks)

National Service Scheme (NSS)			
Course Code	**24NS58**	**CIE Marks**	**25*4 = 100**
Teaching Hours/Week (L: T: P)	**0:0:3:1**	**SEE Marks**	**000**
Credits	**NCMC – Non-Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)**	**Total Marks**	**25*4 = 100**
Contact Hours	**40 hours Practical Session + 15 hours Planning**	**Exam Hours**	**—-**
Examination type (SEE)	**Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)**		

Course Objectives:

Course objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem –solving.
3. Develop among them 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 in general.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.

2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.

3. Support and guide the students for self-planned activities.

You will also be responsible for assigning homework, grading assignments and quizzes, and cumenting students' progress in real activities in the field.

4. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ NSS scheme & syllabus for 2022 scheme from 3rd sem to 6th sem 2 technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure

- **NOTE:**

Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
5th Sem for 25 Marks	1. Developing Sustainable Water management system for rural areas and implementation approaches. 2. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 3. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmer's land/Villages/ roadside / community area/ College campus etc…	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Waste management– Public, Private	May be individ	Villages/ City Areas / Grama panchayat/ public	Site selection /proper consultation/Conti	Report should be	Evaluation as per the

	and Govt organization, 5 R's.	u al or team	associations/Gover nme nt Schemes officers/ campus etc…..	nu ous monitoring/ Information board	submitt ed by individ ual to the concern ed evaluati on authorit y	rubrics Of scheme and syllabus by NSS officer
3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individ u al or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…	Group selection/pro per consultation/Conti nu ous monitoring/ Information board	Report should be submitt ed by individ ual to the concern ed evaluati on authorit y	Evaluati on as per the rubrics Of scheme and syllabus by NSS officer
4	Water conservation techniques – Role of different stakeholders– Implementation.	May be individ ual or team	Villages/ City Areas / Grama panchayat/ public associations/Gover nment Schemes officers/ campus etc.,	site selection / proper consultation/Conti nuous monitoring/ Information board	Report should be submitt ed by individ ual to the concern ed evaluati on authorit y	Evaluati on as per the rubrics Of scheme and syllabus by NSS office

5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…	Group selection/pro per consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs et	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.,	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

SL NO	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1 , Selection of topic, PHASE - 1

4	Commencement of activity and its progress - PHASE - 2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student 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.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general

Assessment Details for CIE (both CIE and SEE)

<table>
<tr><td>Weight age</td><td>CIE – 100%</td><td rowspan="7">Implementation strategies of the project (NSS work). The last

report should be signed

by NSS Officer, the HOD and principal.

At last report should be

evaluated by the

NSS officer of the

Institute.

Finally the consolidated marks sheet should be sent to the

university and also to

Be made available at

LIC visit.</td></tr>
<tr><td>Presentation - 1

Selection of topic, PHASE - 1</td><td>10MARKS</td></tr>
<tr><td>Commencement of activity and its progress - PHASE - 2</td><td>10 Marks</td></tr>
<tr><td>Case study based Assessment Individual performance</td><td>10 Marks</td></tr>
<tr><td>Sector wise study and its consolidation</td><td>10 Marks</td></tr>
<tr><td>Video based seminar for 10 minutes by each student At the end of semester with Report.</td><td>10 Marks</td></tr>
<tr><td>Total marks for the course in each semester</td><td>10 Marks</td></tr>
<tr><td colspan="3">Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the

VTU portal.</td></tr>
<tr><td colspan="3">25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3 rd to 6th

sem, Report and assessment copy should be made available in the department semester wise.</td></tr>
<tr><td colspan="3">Students should present the progress of the activities as per the schedule in the prescribed practical session in

the field. There should be positive progress in the vertical order for the benefit of society in general</td></tr>
</table>

Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

2. Government of Karnataka, NSS cell, activities reports and its manual.

3. Government of India, NSS cell, Activities reports and its manual.

Physical Education (Sports and Athletics) syllabus

SEMESTER V

PHYSICAL EDUCATION (SPORTS & ATHLETICS)– I

Course Code	**24PE58**	**CIE Marks**	100
Credits: L:T:P	0:0:1		
Total Hours	25 P		

Course Outcomes : At the end of the course, the student will be able to

1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I: Orientation **4 Hours**

A. Lifestyle
B. Health & Wellness
C. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **4 Hours**

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr

Module III: Specific games (Anyone to be selected by the student) **16 Hours**

1)Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2)2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 36Up.

Scheme and Assessment for auditing the course and Grades:

SI.No.	Activity	Marks
1.	Participation of student in all the modules	20
2	Quizzes – 2, each of 15 marks	20
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
Total		**100**

YOGA FOR A BETTER LIFE		Semester	V sem
Course Code	**24YO58**	**CIE Marks**	**100/sem**
Teaching Hours/Week (L:T:P:S)	**3:0:2:0**	**SEE Marks**	**000**
Total Hours of Pedagogy Per semester	**24-28 hours (Theory practical)**	**Total Marks**	**100/sem**
Examination nature (SEE)	**Objective type Theory/Practical/Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve body flexibility,

- performance,
- stress reduction,
- attainment of inner peace, and
- Self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as coronary heart disease,

- Depression,
- Anxiety disorders,
- Asthma, and
- Extensive rehabilitation for disorders including musculoskeletal problems and
- Traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

Physical

1. Improved body flexibility and balance
2. Improved cardiovascular endurance (stronger heart)
3. Improved digestion
4. Improved abdominal strength
5. Enhanced overall muscular strength
6. Relaxation of muscular strains
7. Weight control
8. Increased energy levels
9. Enhanced immune system

Mental

1. Relief of stress resulting from the control of emotions
2. Prevention and relief from stress-related disorders
3. Intellectual enhancement, leading to improved decision-making skills

Spiritual

1. Life with meaning, purpose, and direction
2. Inner peace and tranquility
3. Contentment

Yoga Syllabus

Semester V

Patanjali's Ashtanga Yoga its need and importance

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
2. Vakrasana
3. Yogamudra in Padmasana

b. Standing 1. UrdhvaHastothanasana
2. Hastapadasana
3. ParivrittaTrikonasana
4. Utkatasana

c. Prone line 1. Padangushtha Dhanurasana
2. Poorna Bhujangasana / Rajakapotasana

d. Supine line 1. Sarvangasana
2. Chakraasana
3. Navasana/Noukasana

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas, method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by
- a Multiple choice questions
- b. Descriptive type questions (Two internal assessment tests with 25 marks /test)
- Final test shall be conducted for whole syllabus for 50marks.
- ContinuousInternalEvaluationshallbefor100 marks (including IA test)

Suggested Learning Resources:

Books:

1. **Yoga pravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr.M L Gharote &Dr.SKGanguly**
4. **Yoga Instructor Course hand book published by SVYASA University,Bengaluru**
5. **Yoga for Children–step by step–by YaminiMuthanna**

Web links and Video Lectures(e-Resources):Refer links

1. **https://youtu.be/KB-TYlgd1wE**
2. **https://youtu.be/aa-TG0Wg1Ls**

4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

VI SEMESTER

Gen AI and Cyber Law Ethics			
Course Code	24CS61	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	03
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Basic knowledge of computer systems and programming concepts
- Fundamental understanding of Artificial Intelligence and Machine Learning concepts
- Basic awareness of data handling, internet technologies, and cybersecurity concepts
- Introductory understanding of ethical issues related to technology usage
- Familiarity with legal and regulatory aspects of information technology is desirable

Course Objectives:

- Learn key principles of AI ethics, summarizing ethical considerations and applications in AI development and deployment.
- To gain foundational knowledge of core AI technologies, including machine learning, natural language processing, and large language models, and their applications.
- Apply policies and framework for Fairness in AI and Machine Learning.
- Apply privacy and security concepts, risk management and regulatory compliance in the field of AI and Cyber Security.
- Understand the nature of cybercrimes, the principles of intellectual property rights (IPR), and the legal measures necessary to address and prevent these issues.

Teaching-Learning Process (General Instructions)

These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.

Module-1	08 Hours

Introduction: Generative AI, Cybersecurity, Ethics, AI to GenAI: Milestones and Evolutions, AI in Cybersecurity, Introduction to Ethical considerations in GenAI, Overview of the Regional Regulatory Landscape for GenAI.

Understanding GenAI: Types of GenAI, Current technological landscape, Tools and Frameworks, Platforms and services, Libraries and Tools for Specific Applications, A few common algorithms.

Text Book 1: Chapter 1 (1.4 to 1.10), Chapter 3 (3.1 to 3.5, 3.7)

Module-2	08 Hours

GenAI in Cybersecurity: The Dual-Use Nature of GenAI in Cybersecurity, Applications of GenAI in Cybersecurity, Potential Risks and Mitigation Methods.

Foundations of Ethics in GenAI: Basic Ethical Principles and Theories, Existing Regulatory Landscape: The Role of International Standards and Agreements, why separate Ethical Standards for GenAI? United Nation's Sustainable Development Goals, Existing Laws and Regulations affecting GenAI.

Text Book 1: Chapter 4 (4.1 to 4.3), Chapter 5 (5.2 to 5.5, 5.7)

Module-3	08 Hours

Ethical Design and Development: Stakeholder Engagement, Explain Ability in GenAI Systems, Privacy Protection, Accountability, Bias Mitigation, Robustness and Security, Human Centric Design, Regulatory Compliance, Ethical Training Data, Bias and Fairness in GenAI Models.

Text Book 1: Chapter 6 (6.1 to 6.9, 6.16),

Module-4	08 Hours

Cyber Law and Cyber Ethics: The importance of Cyber Law, The Significance of Cyber Ethics, Cyber Crime is Unethical and Illegal, Ethics Information has Positive Impact, The Need for Cyber Regulation Based on Cyber Ethics, Very Dangerous Times.

Ethics in the Information Society: The Nine P's.

Text Book 2: Chapter 2, 3

Module-5	08 Hours

Cyber Crime: Cyber Crime Offenses, Computer-Related Offenses, Content-Related Offenses, Government Efforts in Cybersecurity, Cybersecurity in the Academic World.

Ethics and Intelligence in the 21st Century: Introduction, The Context of Intelligence, Classical and Current Thinking on Ethics, 21st Century Intelligence: New Challenges for Ethics, Three Dilemmas: Ethical Intelligence in Practice, Prospects for a Just Future.

Text Book 2: Chapter 19, 20

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Explain and analyses the fundamental concepts and applications of GenAI models, including their capabilities and limitations. (PO – 1, 2, 6, 7, 11 PSO- 1, 2, 3)

CO2: Evaluate and apply GenAI techniques in cybersecurity contexts, including threat detection, vulnerability assessment and risk mitigation strategies. (PO – 1, 2, 3, 4, 5, 6, 7, 11 PSO – 1, 2, 3)

CO3: Design AI systems incorporating ethical principles such as fairness, transparency, accountability to ensure responsible AI development. (PO – 1, 2, 3, 5, 6, 7 PSO-1, 2, 3)

CO4: Interpret and assess cyber laws, data protection regulations and AI governance to ensure legal and ethical compliance in AI deployment. (PO – 1, 2, 3, 4, 5, 6, 7, 11 PSO – 1, 2)

CO5: Analyze cybercrime mechanisms, including AI enabled attacks, digital forensics basics and legal remedies and propose preventive and corrective measures. (PO – 1, 2, 6, 7, 11 PSO – 1, 2)

are conducted then the sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the Institute as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Text Books:

1. "Generative AI, Cybersecurity and Ethics", Ray Islam, John Wiley & Sons, 2024.
2. "Cyber Ethics 4.0", Christoph Stuckelberger, Pavan Duggal, by Glob ethic.

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=VqFqWIqOB1g
- https://www.youtube.com/watch?v=hVJqHgqF59A
- https://www.youtube.com/watch?v=O5RX_T4Tg24
- https://www.youtube.com/watch?v=RJZ0pxcZsSQ

Advanced Machine Learning Algorithm and its Applications			
Course Code	24CS62	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	03
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Machine Learning Basics
- Linear Algebra
- Probability and Statistics

Course Objectives:

- To teach the theoretical foundations of various learning algorithms.
- To train the students better understand the context of supervised and unsupervised learning through real-life examples.
- Apply all learning algorithms over appropriate real-time dataset.
- Evaluate the algorithms based on corresponding metrics identified.

Teaching-Learning Process (General Instructions)

These are sample Strategies that teachers can use to accelerate the attainment of the various course outcomes.

1. Chalk and Talk
2. Animated videos to demonstrate the applications
3. Collaborative Learning
4. Problem based Learning
5. Power point presentation

Module-1 **8 Hours**

Important Elements in Machine Learning: Data formats, Learnability, Statistical Learning Approaches.

Feature Selection: scikit-learn toy datasets, creating training and test sets, Managing Categorical data, Managing Missing Features.

Text Book 1: Chapter 2 & 3

Module-2	8 Hours
Feature Engineering: Data scaling and normalization, Feature selection and filtering, Principal Component Analysis. **Linear Regression:** Linear Models, Ridge, Lasso and Elastic Net, Polynomial Regression. **Text Book 1: Chapter 3 & 4**	
Module-3	**8 Hours**
Logistic Regression: Linear Classification, Logistic Regression, Implementation ad optimizations, Stochastic gradient descent algorithms, Finding the optimal hyperparameters through grid search, Classification metrics, ROC curve. **Text Book 1: Chapter 5**	
Module-4	**8 Hours**
Naïve Bayes: Bayes' theorem, Naïve Bayes classifiers, Naïve Bayes in scikit-learn. **Support Vector Machines:** Linear support vector machines, scikit-learn implementation, Controlled support vector machines, Support vector regression. **Text Book 1: Chapter 6 & 7**	
Module-5	**8 Hours**
Decision Trees: Binary decision trees, Decision tree classification with scikit-learn. **Applications of Machine Learning:** Introduction, Pattern Recognition, Video Processing, Medical Imaging, List of possible real-world applications. **Text Book: Chapter 8 and Text Book 2: Chapter 8 – 8.1 to 8.4, 8.6**	

Lab Programs

S. No	Experiments
1.	Develop a program to create histograms for all numerical features and analyse the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
2.	Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California Housing dataset.

3.	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
4.	For a given set of training data examples stored in a .CSV file, implement and demonstrate to find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
5.	Develop a program to implement k-Nearest Neighbour algorithm to classify the randomly generated 100 values of x in the range of [0,1]. Perform the following based on dataset generated. 1. Label the first 50 points $\{x_1,\ldots\ldots,x_{50}\}$ as follows: if ($x_i \leq 0.5$), then x_i ε Class 1, else x_i ε Class2 2. Classify the remaining points, $x_{51},\ldots\ldots,x_{100}$ using KNN. Perform this for $k=1,2,3,4,5,20,30$
6.	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7.	Develop a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression.
8.	Develop a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.
9.	Develop a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets.
10.	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Analyze fundamental machine learning concepts and data preparation techniques, including feature selection, handling missing data, and dataset preparation, to build learnable and statistically sound models. (PO – 1,2,3,5,11 PSO – 1,2,3)

CO2: Apply feature engineering and linear regression techniques, including regularization and dimensionality reduction, to improve model performance on real-world datasets. (PO – 1,2,3,5,11 PSO – 1,2,3)

CO3: Design and evaluate classification models using logistic regression and optimization techniques, and assess their performance using appropriate classification metrics. (PO – 1,2,3,5,11 PSO – 1,2,3)

CO4: Develop and implement probabilistic and margin-based learning models such as Naïve Bayes and Support Vector Machines for classification and regression problems. (PO – 1,2,3,5,11 PSO – 1,2,3)

CO5: Identify and analyze real-world applications of machine learning in domains such as pattern recognition, video processing, and medical imaging, and justify suitable algorithms for each application. (PO – 1,2,3,5,11 PSO – 1,2,3)

Assessment Details (CIE and SEE)

1. Weightage of Assessment

1.1 The weightage of Continuous Internal Evaluation (CIE) shall be 50% of the total marks.

1.2 The weightage of Semester End Examination (SEE) shall be 50% of the total marks.

2. Minimum Passing Requirements

2.1 The minimum passing mark for CIE shall be 40% of the maximum marks, i.e., 20 marks out of 50.

2.2 The minimum passing mark for SEE shall be 35% of the maximum marks, i.e., 18 marks out of 50.

2.3 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a course if the student secures a minimum of 40% of the total marks, i.e., 40 marks out of 100, in the aggregate of CIE and SEE.

3. Continuous Internal Evaluation (CIE) for IPCC

3.1 Integrated Professional Core Course (IPCC) refers to a course in which the practical component is integrated with the theory component.

3.2 The maximum marks allotted for CIE in IPCC shall be 50 marks, distributed as follows:

a) Theory Component: 25 marks

b) Practical Component: 25 marks

4. CIE – Theory Component of IPCC (25 Marks)

4.1 The CIE marks for the theory component shall be distributed as:

a) Two Internal Assessment Tests of 15 marks each, with a duration of one hour per test.

b) other assessment methods for 10 marks.

4.2 The first Internal Assessment Test shall be conducted after completion of 40–50% of the syllabus.

4.3 The second Internal Assessment Test shall be conducted after completion of 85–90% of the syllabus.

4.4 The sum of marks obtained in the two tests and other assessment methods shall be scaled down to 25

marks, which shall constitute the CIE marks for the theory component.

4.5 A student shall secure a minimum of 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

5. CIE – Practical Component of IPCC (25 Marks)

5.1 The CIE marks for the practical component shall be distributed as:

a) 15 marks for conduct of experiments and preparation of laboratory records.

b) 10 marks for a laboratory test conducted after completion of all laboratory sessions.

5.2 On completion of every experiment or program, students shall be evaluated, including viva-voce, and marks shall be awarded on the same day.

5.3 Each laboratory experiment report shall be evaluated for 10 marks. The cumulative marks of all experiment write-ups shall be scaled down to 15 marks.

5.4 The laboratory test shall be conducted for 50 marks with a duration of two to three hours and the marks obtained shall be scaled down to 10 marks.

5.5 The scaled-down marks of the laboratory record evaluation and the laboratory test shall together constitute 25 CIE marks for the practical component.

5.6 A student shall secure a minimum of 40% of 25 marks to qualify in the CIE of the practical component of IPCC.

6. Semester End Examination (SEE) for IPCC – Theory

6.1 The SEE for the theory component of IPCC shall be conducted by the University as per the prescribed schedule.

6.2 The duration of the SEE shall be three hours, and a common question paper shall be set for the course.

6.3 The question paper shall consist of ten questions, each carrying 20 marks.

6.4 There shall be two questions from each module, and each question may have a maximum of three sub-questions, covering a mix of topics from the module.

6.5 Students shall be required to answer five full questions, selecting one question from each module.

6.6 The marks obtained by the student shall be proportionally scaled down to 50 marks.

Suggested Learning Resources:

Textbooks:

1. Giuseppe Bonaccorso, Machine Learning Algorithms, Packt Publishing Ltd, 2017.
2. Indra Nath Chatterjee, Machine Learning and its Application: A Quick Guide for Beginners, Bentham Science Publishers, 2021.

Reference Books:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Media, Inc., October 2022.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Web links and Video Lectures(e-Resources):

- https://ocw.mit.edu/courses/6-036-introduction-to-machine-learning-fall-2020/
- https://developers.google.com/machine-learning/crash-course
- https://www.youtube.com/watch?v=YLczBemZpaE
- https://nptel.ac.in/courses/106106139

DevOps Lab			
Course Code	**24CSL63**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**0:0:2**	**SEE Marks**	**50**
Credits	**1**	**Total Marks**	**100**
Contact Hours	**12 hours of Practical**	**Exam Hours**	**3**
Examination type (SEE)	**Practical**		

Prerequisites:

The students should have knowledge on:

1. **Basic knowledge of Operating Systems**
   Understanding of Linux and Windows operating systems, file systems, processes, and basic shell commands.
2. **Fundamentals of Computer Networks**
   Knowledge of IP addressing, protocols, client–server architecture, and network communication concepts.
3. **Concepts of Software Engineering**
   Understanding of SDLC, version control, CI/CD concepts, and software development life cycle practices.
4. **Basic Programming Skills**
   Ability to write and understand simple programs in languages such as C, Python, or Java.
5. **Version Control Systems**
   Familiarity with Git, GitHub, and basic repository management operations.
6. I**ntroduction to Cloud Computing**
   Basic understanding of cloud service models (IaaS, PaaS, SaaS) and virtual machines.

Course Objectives:

1. **CO1:** Understand DevOps concepts, tools, and best practices for modern software development.
2. **CO2:** Use Git and GitHub for version control and collaborative software development.
3. **CO3:** Build and manage CI/CD pipelines using Jenkins or GitHub Actions.
4. **CO4:** Create and deploy applications using Docker containers and basic orchestration tools.
5. **CO5:** Deploy and manage applications on cloud platforms and virtual machines.
6. **CO6:** Automate infrastructure and configuration using tools such as Ansible and Terraform.

PRACTICAL COMPONENT OF PCC:

Sl. No.	Programs
1.	Introduction to Maven and Gradle: Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup
2.	Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins
3.	Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation
4.	Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle
5.	Introduction to Jenkins: What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use
6.	Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests
7.	Configuration Management with Ansible: Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook
8.	Practical Exercise: Set Up **a Jenkins CI Pipeline for a Maven Project**, Use Ansible to Deploy Artifacts Generated by Jenkins
9	Introduction to Azure DevOps: Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project
10.	Creating Build Pipelines: Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports
11	**Creating Release Pipelines:** Deploying applications to **AWS Elastic Beanstalk**, managing secrets and configuration with **AWS Secrets Manager**, **Hands-On:** Continuous Deployment with **AWS Code Pipeline**.
12	**Creating Release Pipelines:** Deploying applications to **AWS Elastic Beanstalk**, managing secrets and configuration with **AWS Secrets Manager**, **Hands-On:** Continuous Deployment with **AWS Code Pipeline**

Assessment Details (both CIE and SEE):

CIE for the theory component of the IPCC (maximum marks 50)

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

CIE for the practical component of the IPCC

Semester-End Examination:

1. Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).
2. The question paper will have ten questions. Each question is set for 20 marks.

3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.
5. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps – Saurabh Shrivastava, BPB Publications, 1st Edition, 2019.

Reference Books:

1. Learning DevOps: Continuously Deliver Better Software – Mikael Krief & Gauthier Vassal, Packt Publishing, 1st Edition, 2019.
2. Jenkins: The Definitive Guide – John Ferguson Smart, O'Reilly Media, 2nd Edition, 2011.

Web links and Video Lectures(e-Resources):

- **Maven Crash Course (Beginner YouTube Tutorial)**
  https://www.youtube.com/watch?v=Xatr8AZLOsE
- **Maven Full Course – Apache Maven Tutorial**
  https://www.youtube.com/watch?v=uAQs-YXnY-U
- **Azure DevOps Tutorial for Beginners (Step-by-Step)**
  https://www.youtube.com/watch?v=--7g9w0gB9o
- **DevOps Tools Full Course – Jenkins, Ansible, CI/CD (Edureka)**
  https://www.youtube.com/watch?v=FyNvwI02Nhg
- **Jenkins Tutorial Playlist (Beginner to Advanced)**
  https://www.youtube.com/playlist?list=PL9ooVrP1hQOGM6eCsjnfAousUSvpqD8dW

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)

1. **Version Control using Git:** Create and implement a version control system using Git to manage source code changes. Demonstrate repository creation, branching, merging, and collaboration using a remote repository.

Or

Create and implement a Java-based application using Maven for build automation, and set up a Jenkins CI pipeline to fetch code from Git, build the application, and run unit tests on every commit.

Full Stack Web Development with MERN Stack			
Course Code	24CS641	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0:0	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic programming knowledge (JavaScript preferred)
- Fundamentals of HTML & CSS
- Basic understanding of web concepts

Course Objectives:

- To understand and apply JavaScript fundamentals**.**
- To manipulate the DOM and handle events to create interactive and dynamic web pages.
- To utilize React JS to build front end User Interface.
- To understand the usage of APIs to create web application using Express.js.
- To design and interact with MongoDB**,** integrating front-end and back-end to build complete MERN stack applications.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching
methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding

9. Use any of these methods: Chalk and board, Active Learning, Case Studies

Module-1	8 Hours

Basic JavaScript:

Instructions, Statements, Comments, Variables, Data Types, Arrays, Strings, Functions, Methods & Objects, Decisions & Loops

Textbook 1: Chapter 2, 3, 4

Module-2	8 Hours

Document Object Model: DOM Manipulation, Selecting Elements, Working with DOM Nodes, Updating Element Content & Attributes,

Events: Different Types of Events, How to Bind an Event to an Element, Event Delegation, Event Listeners.

Text Book 1: Chapter: 5, 6

Module-3	8 Hours

Introduction to MERN: MERN components, why MERN?

Server less Hello world:

React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

Text book 2: Chapter 1,2,3

Module-4	8 Hours

React State: Initial State, Async State Initialization, Updating State, Lifting State Up, Event Handling, Stateless Components, Designing Components, State vs. Props, Component Hierarchy, Communication, Stateless Components.

Express: Express, REST API, GraphQL, Field Specification, Graph Based, Single Endpoint, Strongly Typed, Introspection, Libraries, The About API GraphQL Schema File, The List API, List API Integration, Custom Scalar types, The Create API, Create API Integration, Query Variables, Input Validations, Displaying Errors.

Textbook 2: Chapter 4, 5

Module-5	8 Hours

MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB.

Textbook 2: Chapter 6

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

CO1: Write client-side programs using JavaScript for validations, logic, and computations.

CO2: Create dynamic and interactive web pages using DOM manipulation and event handling**.**

CO3: Develop React-based front-end applications with state management, props, and component hierarchy.

CO4: Build server-side applications and APIs using Node.js and Express, including REST and GraphQL.

CO5: Implement full-stack MERN applications integrating React, Node.js, Express, and MongoDB with persistent storage.

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:
● For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
● The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
● Any two assignment, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
● For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).
1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbooks:

1. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node. Apress, 2019

Web links and Video Lectures(e-Resources):

- https://github.com/vasansr/pro-mern-stack
- https://nptel.ac.in/courses/106106156
- https://archive.nptel.ac.in/courses/106/105/106105084/

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Assignment 1 (15 marks):

A retail store wants to develop a simple Product Management web application using the MERN stack**.** The application should use JavaScript for client-side validation and DOM event handling for form submission, implement a React front end to display and update the product list dynamically, provide Express APIs to add and retrieve product details, and store data persistently in MongoDB using CRUD operations.

Design and implement this application by integrating React, Express, and MongoDB, and demonstrate dynamic updates of the product list after insertion.

- Assignment 2(10 marks):

A university plans to develop a web-based Student Issue Tracking System using JavaScript and the MERN stack. The application should allow students to report issues through interactive forms using DOM manipulation and event handling, display data dynamically using React components and state**,** provide backend services through Node.js and Express APIs, and store issue details securely in MongoDB**.**

Explain how the MERN stack components and JavaScript concepts are used to implement this system.

Cloud Architect			
Course Code	**24CS642**	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	**3:2:0**	**SEE Marks**	50
Credits	**4**	**Total Marks**	100
Contact Hours	**50 Hrs**	**Exam Hours**	3
Examination type (SEE)	**Theory**		

Prerequisites:

The students should have the:

- Ability to comprehend and apply fundamental concepts of computer systems and operating systems necessary for cloud infrastructure understanding.
- Capability to analyze basic networking configurations and communication protocols relevant to cloud environments.
- Skill to utilize Linux-based systems and command-line tools for managing cloud resources and services.
- Competence in developing basic programs or scripts to support automation, configuration, and orchestration tasks in cloud platforms.
- Awareness of database systems, web application workflows, and virtualization paradigms as a foundation for cloud architecture design**.**

Course Objectives:

- Understand the evolution of cloud computing and explain cloud service models (SaaS, PaaS, IaaS), deployment models, migration strategies, and real-world cloud adoption case studies.
- Develop architectural thinking skills to analyze business problems, identify stakeholders, gather business and technical requirements, and define constraints for cloud-based solutions.
- Assess and select appropriate cloud service models and architectural approaches for various application scenarios, including legacy system migration and common cloud use cases.
- Examine cloud auditing, security, regulatory compliance, and data management considerations to ensure governance, privacy, and reliability in cloud environments.
- Design secure and efficient cloud architectures by applying shared responsibility models, security strategies, and centralized logging and monitoring mechanisms.

Teaching-Learning Process (General Instructions)

1. The course shall be delivered using a blended teaching methodology consisting of lectures, case studies, activity-based learning, and discussions to promote conceptual understanding and practical application of cloud architecture principles.
2. Activity-based learning (ABL) methods such as group discussions, architectural design exercises, and case study analysis shall be incorporated to encourage student participation and critical thinking.
3. Cloud architecture diagrams, flowcharts, videos, and simulation tools shall be used to enhance visualization and comprehension of cloud service models and architectures.
4. Students shall be encouraged to explore cloud platforms (AWS, Azure, or GCP) through free-tier services, demos, or sandbox environments to gain hands-on exposure.
5. Students shall be guided to refer to textbooks, research articles, cloud documentation, and online learning resources to foster independent and life-long learning.

Module-1	**8 Hours**

Cloud, Cloud Services and practices: Evolution of Cloud Computing, Enter the Cloud- case Studies, Infrastructure as a Service, Platform as a Service, Software as a Service, Deployment Models, migrating applications to the Cloud, Misguided Expectations, Misinformed about Cloud Security.

Text book: Chapter 1,2,3

Module-2	**8 Hours**

Start with Architecture: The Importance of Why, Who, what, Where, When, and How, start with the Business Architecture (with case Study), Identify the Problem Statement (Why), Evaluate User Characteristics (Who), Identify Business and Technical Requirements (What), Visualize the Service Consumer Experience (Where), Identify the Project Constraints (When and with What), Understand Current State Constraints (How).

Text book: Chapter 4

Module-3	**8 Hours**

Choosing the Right Cloud Service Model: Considerations When Choosing a Cloud Service Model, When to Use SaaS, When to Use PaaS, When to Use IaaS, Common Cloud Use Cases, The Challenges of Migrating Legacy Systems to the Cloud,

Text book: Chapter 5,6

Module-4	**8 Hours**

Auditing in the Cloud: Data and Cloud Security, Auditing Cloud Applications, Regulations in the Cloud, Audit Design Strategies. **Data Considerations in the Cloud:** Data Characteristics, Multitenant or Single Tenant, Choosing Data Store Types.

Text book: Chapter 7,8

Module-5	8 Hours

Security Design in the Cloud: Responsibilities for Each Cloud Service Model, Security Strategies, Areas of Focus. **Creating a Centralized Logging Strategy:** Log File Uses, Logging Requirements,

Text book: Chapter 9,10

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Explain the fundamental concepts, service models, deployment models, and evolution of cloud computing, and analyze real-world case studies to understand cloud adoption drivers and challenges.
(PO – 1,2,5,11 PSO –1.2.3)

CO2: Apply architectural thinking principles to identify business problems, analyze stakeholder requirements, and design cloud solutions aligned with business, technical, and operational constraints.
(PO – 1,2,3,4,5,6,11 PSO –1,2,3)

CO3: Evaluate and select appropriate cloud service models (SaaS, PaaS, IaaS) for diverse application scenarios, including legacy system migration, based on performance, scalability, and cost considerations.
(PO – 1,2,3,4,5,11 PSO – 1,2,3)

CO4: Analyze cloud security, auditing requirements, regulatory compliance, and data management strategies, including multitenant architectures and data store selection, to ensure governance and accountability.
(PO – 1,2,3,4,5,6,8,11 PSO – 1,2,3)

CO5: Design secure cloud architectures by defining shared responsibility models, implementing security strategies, and developing centralized logging and monitoring mechanisms for effective cloud operations.
(PO – 1,2,3,4,5,11 PSO –1,2,3)

Assessment Details (both CIE and SEE):

CIE for the Theory component of the PCC:

Theory Component	CIE-1 after completion of 45% to 50% of syllabus	25 Marks
	CIE-2 after completion of 95% to 100% of syllabus	25 Marks
	Reduced to 25 Marks with Average of CIE-1 & CIE 2	**25 Marks**
	Assignment -1 (Project Based, Application Based Assignment)	15 Marks

Assignment Component	Assignment – II (Activity based assignment, Quiz, Online Certification, any related)	10 Marks
	Total Assignment Marks	**25 Marks**
	Grand Total of CIE	**50 Marks**

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

To pass the course, the student must:

- Obtain **minimum 40% marks in CIE**
- Obtain **minimum 40% marks in SEE**

Suggested Learning Resources:

Textbook:

1. ARCHITECTINGTHE CLOUD-DESIGN DECISIONS FOR CLOUD COMPUTING SERVICE MODELS (SaaS, PaaS, and laaS) Michael J. Kavis, WILEY.

Reference Textbook:

1. Cloud Computing: Concepts, Technology & Architecture – Thomas Erl, Zaigham Mahmood & Ricardo Puttini
2. Cloud Architecture Patterns – Bill Wilder
3. Designing Data-Intensive Applications – Martin Kleppmann

Web links and Video Lectures(e-Resources):

Video Lecture Resources:

- https://www.mygreatlearning.com/academy/learn-for-free/courses/cloud-computing-architecture
- https://skillbuilder.aws/
- https://learn.microsoft.com/en-us/training/
- https://cloudskillsboost.google/

Web Links :

- https://cloudskillsboost.google/
- https://aws.amazon.com/free/
- https://learn.microsoft.com/training/
- https://cloudfluently.com/resources?utm
- https://www.whizlabs.com/blog/hands-on-labs-beginners-guide
- https://www.linkedin.com/learning/cloud-architecture-advanced-concepts-25626673
- https://www.linkedin.com/learning/topics/professional-cloud-architect
- https://www.pearsonitcertification.com/store/google-cloud-platform-professional-cloud-architect-9780138041236

https://www.oreilly.com/videos/-/9781806672172/
Activity Based Learning (Suggested Activities in Class)/Practical Based Learning • Role Play • Flipped classroom • Experiential Learning (Hands-on sessions) • Activity Based Learning

AI for Computer Vision

Course Code	**24CS643**	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	**3:2:0**	**SEE Marks**	50
Credits	**4**	**Total Marks**	100
Contact Hours	**50 Hrs.**	**Exam Hours**	3
Examination type (SEE)	**Theory**		

Prerequisites:

The students should have the:

- Basic understanding of Linear Algebra, Probability, and Statistics
- Fundamental knowledge of Python programming
- Familiarity with Machine Learning concepts
- Introductory exposure to Neural Networks and Deep Learning
- Basic understanding of digital images and matrices

Course Objectives:

CO1: Understand the fundamental principles of computer vision and image formation.
CO2: Learn classical and AI-based techniques for image processing and visual perception.
CO3: Apply deep learning models for image classification, detection, and segmentation.
CO4: Analyze real-world computer vision applications and ethical considerations.
CO5: Design and evaluate AI-driven vision solutions using modern frameworks.

Teaching-Learning Process (General Instructions)

1. Concepts are delivered through lectures using visual aids, examples, and real-world case studies to improve conceptual understanding and application skills.
2. Students engage in problem-solving and design-based activities to strengthen analytical thinking and practical implementation abilities.
3. Learners work with standard datasets and model architectures to understand complete computer vision pipelines from data to output.
4. Hands-on sessions introduce students to widely used open-source tools for image processing and deep learning applications.
5. Students are encouraged to explore research papers and online labs to enhance self-learning and keep pace with emerging technologies.

Module-1 **8Hours**

Fundamentals of Computer Vision: Introduction to Computer Vision, Human Vision vs Computer Vision, Image Formation Model, Image Representation, Pixels and Color Spaces (RGB, HSV, Grayscale), Sampling and Quantization, Challenges in Computer Vision, Applications and Case Studies. **Textbook: Chapter 1,2**
Module-2 8Hours
AI-Enhanced Image Processing: Image Enhancement Techniques using Classical and AI Approaches, Spatial and Frequency Domain Filtering, Learning-based Image Denoising and Super-Resolution, Edge Detection using Classical Operators (Sobel, Canny) and AI-based Edge Learning Models, Feature Detection and Description using Traditional Methods (Corners, SIFT, SURF, ORB) **Textbook: Chapter 3,4**
Module-3 8Hours
AI-Driven Machine Learning for Computer Vision: Traditional Machine Learning Pipelines for Computer Vision and their Transition toward AI-driven Approaches, Feature Vectors and Feature Learning, k-Nearest Neighbors (k-NN) and Support Vector Machines (SVM) for Image Classification, Bag of Visual Words (BoVW) Model, Dimensionality Reduction using PCA, Evaluation Metrics for Vision Models, Limitations of Classical Methods and Motivation for Deep AI-based Vision Systems. **Textbook: Chapter 5**
Module-4 8Hours
Deep Learning for Computer Vision: Deep Feature Learning, Image Transformations and Data Augmentation for AI Models, Histogram Processing and Contrast Enhancement, Feature Representation using Autoencoders, Role of Feature Extraction in AI-driven Vision Pipelines. **Textbook: Chapter 6,7**
Module-5 8Hours
Advanced Vision Tasks and Applications: Object Detection (R-CNN, YOLO, SSD), Image Segmentation (Semantic & Instance), Vision Transformers (ViT – overview), Applications: Medical Imaging, Autonomous Vehicles, Surveillance, Ethical Issues and Bias in Vision Systems. **Textbook: Chapter 8, 9**

Course outcomes (Course SkillSet):

At the end of the course, the student will be able to:

CO1: Explain core concepts of computer vision, image representation, and processing techniques. (PO – 1,2,5,11 | PSO – 1,2,3)

CO2: Apply image processing and feature extraction techniques to solve vision problems. (PO – 1,2,3,4,5 | PSO – 1,2,3)

CO3: Analyze and implement machine learning approaches for visual data. (PO – 1,2,3,4,5,11 | PSO – 1,2,3**)**

CO4: Design deep learning-based computer vision models for classification and detection tasks. (PO – 1,2,3,4,5,6,11 | PSO – 1,2,3)

CO5: Evaluate advanced computer vision systems and assess real-world applications with ethical considerations. (PO – 1,2,3,4,5,8,11 | PSO – 1,2,3)

Assessment Details (both CIE and SEE):

CIE for the Theory component of the PCC:

Theory Component	CIE-1 after completion of 45% to 50% of syllabus	25 Marks
	CIE-2 after completion of 95% to 100% of syllabus	25 Marks
	Reduced to 25 Marks with Average of CIE-1 & CIE 2	**25 Marks**
Assignment Component	Assignment -1 (Project Based, Application Based Assignment)	15 Marks
	Assignment – II (Activity based assignment, Quiz, Online Certification, any related)	10 Marks
	Total Assignment Marks	**25 Marks**
	Grand Total of CIE	**50 Marks**

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

To pass the course, the student must:

- Obtain **minimum 40% marks in CIE**
- Obtain **minimum 40% marks in SEE**

Suggested Learning Resources:

Textbook:

1. Computer Vision: Algorithms and Applications – Richard Szeliski, Springer
2. Deep Learning for Computer Vision – Rajalingappaa Shanmugamani, Packt

Reference Textbook:

1. Learning OpenCV – Gary Bradski & Adrian Kaehler
2. Deep Learning – Ian Goodfellow, Yoshua Bengio, Aaron Courville
3. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow – Aurélien Géron

Web links and Video Lectures(e-Resources):

Video Lecture Resources:

- https://www.coursera.org/learn/computer-vision-basics
- https://www.udemy.com/course/python-for-computer-vision-with-opencv-and-deep-learning/
- https://www.youtube.com/playlist?list=PLlMkM4tgfjnLSOjrEJN31gL4ZsZIB9KVU/
- https://learnopencv.com/tutorials/

Web Links :

- https://opencv.org/
- https://pytorch.org/tutorials/
- https://www.tensorflow.org/tutorials/images
- https://paperswithcode.com/area/computer-vision
- https://www.analyticsvidhya.com/blog/2021/03/computer-vision-for-beginners/
- https://deepai.org/machine-learning-glossary-and-terms/computer-vision
- https://www.kaggle.com/learn/computer-vision
- https://ai.google/education/vision/
- https://scikit-image.org/

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play
- Flipped classroom
- Experiential Learning (Hands-on sessions)
- Activity Based Learning

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	1	–	–	–	–	–	2	2	3	2
CO2	2	3	3	2	2	1	–	–	–	2	2	3	3	2
CO3	2	3	3	2	3	–	–	–	–	2	2	3	3	3
CO4	2	3	2	3	3	2	–	2	–	–	2	3	3	3
CO5	2	2	3	2	3	–	–	2	–	2	2	3	3	3

	DATA SECURITY AND PRIVACY		Semester	6
	Course Code	**24CS644**	CIE Marks	50
	Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
	Total Hours of Pedagogy	50	Total Marks	100
	Credits	04	Exam Hours	3
	Examination type (SEE)	Theory		

Course objectives:

1. Understand the basics of, Security, its principle and Cryptography
2. To study various symmetric and asymmetric cryptographic Algorithm
3. Apply the knowledge of Cryptography to various fields
4. Study the key management system
5. Understand the necessity of data security

Teaching-Learning Process

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Use any of these methods: Chalk and board, Active Learning, Case Studies

Module-1 10 hours

	Basic Cryptography models : A model for Network Security, Classical encryption techniques: Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography. Implementations on Basic Ciphers Block Ciphers and Data Encryption Standards: Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles **Text book 1:** **Chapter 1: 1.8 Chapter 3: 3.1, 3.2, 3.5 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5**
	Module-2 10 hours
	Pseudorandom number Generators: Linear algebra & Congenital Generators, Blum Blum Shub Generator **Public key cryptography and RSA:** Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA **Diffie-Hellman key exchange:** The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography **Text book 1:** **Chapter 8: 8.2 Chapter 9: 9.1, 9.2 Chapter 10: 10.1, 10.4**
	Module-3 10 hours
	Key Management and models : Key management fundamentals, Key lengths and lifetimes, Key generation, Key establishment, Key storage, Key usage, Governing key management. Public-Key Management: Certification of public keys, The certificate lifecycle, Public-key management models, Alternative approaches. **Text book 2:** **Chapter 10, Chapter 11**
	Module-4 10 hours

	Data Privacy : Web security consideration, Transport layer security,Pretty Good Privacy(PGP) **IP Security:** IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange**. Implementation on IP security** **Text book1:** **Chapter 17: 17.1, 17.2 Chapter 20: 20.1, 20.2, 20.3 20.4, 20.5**
	Module-5 10 hours
	Data Security: Data hiding in Text-Basic features, Applications of data hiding, Watermarking, Intuitive Methods, Simple Digital methods, Data hiding in Text, Innocuous Text, Mimic Functions. **Data hiding in Images:** LSB encoding, BPCS Steganography, Lossless data hiding **Textbook 3:** **Chapter 10: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8** **Chapter 11: 11.1, 11.2, 11.3**

Course outcome

At the end of the course, the student will be able to:

CO1: Explain the basic concepts of Security and Cryptography.

(PO – 1,2,5,11 PSO –1.2.3)

CO2: Apply and analyze various Cryptographic Algorithms, Mechanisms of various attacks and solutions.

(PO – 1,2,5,6,11 PSO –1.2.3)

CO3: Evaluate and describe various key management models and implementations.

(PO – 1,2,5,11 PSO –1.2.3)

CO4: Analyze and explain about IP security and Web security. (PO – 1,2,5,6,8,11 PSO –1.2.3)

CO5: Apply the Data security concepts for Text and images. (PO – 1,2,3,4,5,11 PSO –1,2,3)

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.

CIE for the Theory component of the PCC:

Theory Component	CIE-1 after completion of 45% to 50% of syllabus	25 Marks
	CIE-2 after completion of 95% to 100% of syllabus	25 Marks
	Reduced to 25 Marks with Average of CIE-1 & CIE 2	**25 Marks**
Assignment Component	Assignment -1 (Project Based, Application Based Assignment)	15 Marks
	Assignment – II (Activity based assignment, Quiz, Online Certification, any related)	10 Marks
	Total Assignment Marks	**25 Marks**
	Grand Total of CIE	**50 Marks**

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books

Textbook

1. **Cryptography and Network Security",** William Stallings, Pearson Publication, Seventh Edition.
2. **Everyday Cryptography:** Fundamental Principles and Applications Keith M. Martin Oxford Scholarship Online: December 2013.
3. **Data Privacy and Security**, Salomon, David, Springer, 2003.

Reference Books:

1. **Cryptography and Network Security,** Behrouz A Forouzan, Dedeep Mukhopadhyay, TMH, 2nd edition, 2013

Information Security: Principles and practice, Mark Stamp,
Wiley Inter Science, 2011

Web links and Video Lectures(e-Resources):

Video Lecture Resources:

- Free Cryptography Course Online (2026) - Great Learning
- https://www.udemy.com/course/data-security-and-privacy-training

Web Links :

- https://cloudian.com/guides/data-protection/data-protection-and-privacy-7-ways-to-protect-user-data/
- https://www.oreilly.com/videos/data-
- https://www.w3schools.com/cybersecurity/

https://www.ibm.com/think/topics/data-privacy-examples

Activity Based Learning (Suggested Activities in Class)/Practical Based Learning

- Role Play/Impromptu Seminars
- Flipped classroom/Class Implementation in groups
- Experiential Learning (Hands-on sessions)

Activity Based Learning/Solving various Encryption/Decryption Cipher Algorithms.

RESEARCH METHODOLOGY & IPR

Course Code	24RM65	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Course Objectives:

- CO1. To Understand the knowledge on basics of research and its types.
- CO2. To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
- CO3. To learn Ethics in Engineering Research.
- CO4. To Discuss the concepts of Intellectual Property Rights in engineering.

Teaching-Learning Process (General Instructions)

1. These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.
2. Lecturer methods (L) need not be only the traditional lecture methods, but alternative effective teaching methods could be adopted to attain the outcomes.
3. Use of Video to explain various concepts on IPR.
4. Encourage collaborative (Group Learning) Learning in the class.
5. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
6. Introduce Topics in manifold representations.
7. Show the different ways to analyze the research problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps Improve the students' understanding.

Module-1 **8 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

Text Book :1

Module-2 **8 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.

Text Book :1

Module-3 **8 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.

Text Book :1

Module-4 **8 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 Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types ofTrademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Text Book :1

Module-5 **8 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**

Text Book :1

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1. To know the meaning of engineering research. (PO- 1,2,4 PSO-1,2,3)

CO2. To know the procedure of the literature Review and Technical Reading (PO- 1,2,4,5,8,10 PSO-PSO-1,2,3)

CO3. To understand the fundamentals of the patent laws and drafting procedure (PO-1,2,3,6,8,10,11 PSO-1,2,3)

CO4. Understanding the copyright laws and subject matters of copyrights and designs (PO- 1,3,6,8,10,11 PSO-1,2,3)

CO5. Understanding the basic principles of design rights (PO-1,2,3,6,8,10,11 PSO-1,2,3)

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). The student is declared as a pass in the course if he/she 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:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Textbook:

1. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.

Reference Book:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-
2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition.ISBN: 978-93-81849-30-9

Web links and Video Lectures(e-Resources):

Video Lecture Resources:

- https://alison.com/course/essentials-of-research-methodology?utm_
- https://www.udemy.com/courses/search/?q=research+methodology

Web Links:

- https://repository.ncrm.ac.uk/search/?q=reaearch%20methadology#gsc.tab=0&gsc.q=reaearch%20methadology&gsc.page=1
- https://www.udemy.com/courses/search/?q=research+methodology
- https://academicearth.org/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

National Service Scheme (NSS)			
Course Code	**24NS68**	**CIE Marks**	**25*4 = 100**
Teaching Hours/Week (L: T: P)	**0:0:3:1**	**SEE Marks**	
Credits	**NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)**	**Total Marks**	**25*4 = 100**
Contact Hours	**40 hour Practical Session +15 hour Planning**	**Exam Hours**	
Examination type (SEE)	**Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)**		

Course Objectives:

Course objectives: National Service Scheme (NSS) will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem – solving.
3. Develop among them 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 in general.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.

2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.

3. Support and guide the students for self-planned activities.

You will also be responsible for assigning homework, grading assignments and quizzes, and cumenting students' progress in real activities in the field.

4. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 Rs.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ NSS scheme & syllabus for 2022 scheme from 3rd Sem to 6th Sem 2 technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For e.g. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs. (minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure

- NOTE:

Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.

At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic i
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs. (minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 MARKS	1. Plantation and adoption of plants. Know your plants. 2. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic

1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmer's land/Villages/ roadside / community area/ College campus etc…	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…	Group selection/pro per consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4	Water conservation techniques – Role of different	May be individual or	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes	site selection / proper consultation/Continu ous monitoring/	Report should be submitted by	Evaluation as per the rubrics Of

	stakeholders– Implementation.	team	officers/ campus etc…..	Information board	individual to the concerned evaluation authority	scheme and syllabus by NSS officer
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…	Group selection/pro per consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7	Developing Sustainable Water management system for rural areas and implementation	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the	Evaluation as per the rubrics Of scheme and syllabu

	approaches.				concerned evaluation authority	s by NSS officer
8	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs et	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

					authority	
11	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

SL No.	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1, Selection of topic, PHASE - 1
4	Commencement of activity and its progress - PHASE - 2
5	Execution of Activity

6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

At the end of the course, the student 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.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general

Assessment Details for CIE (both CIE and SEE)

<table>
<tr><td>Weight age</td><td>CIE – 100%</td><td rowspan="8">Implementation strategies of the project (NSS work). The last

report should be signed

by NSS Officer, the HOD and principal.

At last report should be evaluated by the NSS officer of the Institute.

Finally the consolidated marks sheet should be sent to the university and also to

Be made available at LIC visit.</td></tr>
<tr><td>Presentation - 1

Selection of topic, PHASE - 1</td><td>10MARKS</td></tr>
<tr><td>Commencement of activity and its progress - PHASE - 2</td><td>10 Marks</td></tr>
<tr><td>Case-study based Assessment Individual performance</td><td>10 Marks</td></tr>
<tr><td>Sector wise study and its consolidation</td><td>10 Marks</td></tr>
<tr><td>Video based seminar for 10 minutes by each student At the end of semester with Report.</td><td>10 Marks</td></tr>
<tr><td>Total marks for the course in each semester</td><td>10 Marks</td></tr>
<tr><td colspan="3">Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.</td></tr>
<tr><td colspan="3">25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3 rd to 6th Sem, Report and assessment copy should be made available in the department semester wise.</td></tr>
<tr><td colspan="3">Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general</td></tr>
<tr><td colspan="3">Suggested Learning Resources:

Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

2. Government of Karnataka, NSS cell, activities reports and its manual.

3. Government of India, NSS cell, Activities reports and its manual.</td></tr>
</table>

Indian Knowledge System			
Course Code	24IKS69	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	1:0:0	**SEE Marks**	-
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)	**Total Marks**	100
Contact Hours	28	**Exam Hours**	-
Examination type (SEE)	NA		

Course objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Module-1	**5 Hours**
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.	
Module-2	**5 Hours**
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements-Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.	
Module-3	**5 Hours**
Traditional Knowledge in Professional domain: Town planning and architecture- Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	

Course outcomes (Course Skill Set)

At the end of the course, the student will be able to:

CO1. Provide an overview of the concept of the Indian Knowledge System and its importance.PO-1,7,11

CO2. Appreciate the need and importance of protecting traditional knowledge. PO6

CO3. Recognize the relevance of Traditional knowledge in different domains.PO-3,4

CO4. Establish the significance of Indian Knowledge systems in the contemporary world.PO6

Reference Books

1	**Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2	**Traditional Knowledge System in India**, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3	**Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

Suggested Web Links:

1.	https://www.youtube.com/watch?v=LZP1StpYEPM
2.	http://nptel.ac.in/courses/121106003/

3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7.	https://unfoundation.org/what-we-do/issues/sustainable-development goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE

ASSESSMENT AND EVALUATION PATTERN	
WEIGHTAGE	**100% (CIE)**
QUIZZES	
Quiz-I	Each quiz is evaluated for 10 marks adding up to **20 Marks**
Quiz-II	
THEORY COURSE - (Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating)	
Test – I	Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to **40 Marks**
Test – II	
EXPERIENTIAL LEARNING	**40**
Case Study-based Teaching-Learning	**--**
Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ ITeS)	**--**
Video based seminar (4-5 minutes per student)	**--**
Maximum Marks for the Theory	**--**
Practical	**--**
Total Marks for the Course	**100**