SOFTWARE ENGINEERING & PROJECT MANAGEMENT			
Course Code	24AD51	**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:

- Outline software engineering principles and activities involved in building large software programs.
- To understand the AGILE process and implementation.
- Recognise the importance of Project Management with its 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 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 **8 Hours**

Software Engineering: The nature of Software, The unique nature of WebApps, 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 scenario. **CO2:** Analyze the various AGILE Process Models. **CO3:** Illustrate the role of project planning and project evaluation. **CO4:** Understand the importance of software estimation and risk management. **CO5:** Identify appropriate techniques to enhance software quality.	

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)**

1. First test at the end of 5th week of the semester

2. Second test at the end of the 10th week of the semester

3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester

5. 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)**

6. 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**)

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored

shall be proportionally reduced to 50 marks

2. There will be 2 questions from each module. Each of the two questions under a module (with amaximum 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.

1. 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/watch?v=g0wFbJkHsU8
- https://www.youtube.com/watch?v=0MEAkczQqJ8

Theory of Computation			
Course Code	24AD52	**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 grammar 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. Lecture 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 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.
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 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)

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

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

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

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

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://nptel.ac.in/courses/10610414 8
- · https://nptel.ac.in/courses/106106049
- · https://onlinecourses.nptel.ac.in/noc21_cs83/preview
- https://www.coursera.org/learn/cs-algorithms-theory-machines

COMPUTER NETWORKS			
Course Code	24AD53	**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 the 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, typed at 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)

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)

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)

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)

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)

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,5thEdition,TataMcGraw-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.

3. 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/106106091

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

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

Data Visualization using Power BI and Tableau			
Course Code	24ADL54	**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		

Prerequisites:

The students should have knowledge on

- Analytical thinking
- Microsoft Excel
- Database Management System
- Statistical concepts

Course Objectives:

- Understand the Importance of Data Visualization for business intelligence and decision making.
- Learn different approaches to understand the importance of visual perception.
- Learn different data visualization techniques and tools.
- Gain knowledge of effective data visuals to solve workplace problems.

Teaching-Learning Process (General Instructions)

Teachers can use the 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

Programs List:

1.	**Getting Started** - Tableau Workspace, Tableau terminologies, basic functionalities, Connecting to Database, Different types of Tableau Joins.
2.	**Creating a View** - formatting charts, adding filters, creating calculated fields and defining parameters. **Dashboard Design and Storytelling** – Components of Dashboard, Understanding how to place worksheets in Containers, Action filters and its types.
3.	**Introducing Power BI** –Components and the flow of work. Power BI Desktop Interface-The Report has five main areas. **Querying Data from CSV** - Query Editor, Connecting the data from the Excel Source, Clean, Transform the data.
4.	**Creating Reports & Visualizations** - Different types of charts, Formatting charts with Title, Colors. **Dashboards** - Filters in Power BI, Formatting dashboards.
5.	Analysis of Student Performance Dataset: i. Create Bar charts (scores by gender & parental education) ii. Create Box plots for Scores iii. Apply Filters for demographics iv. Build an interactive Dashboard

6.	Financial Performance Dashboard: i. Create KPI Cards to show Revenue, Profit, and Profit Margin ii. Create a Line Chart to show Monthly profit trend iii. Create a Bar Chart to show Revenue by region iv. Create an interactive Dashboard
7.	Analysis of revenue in sales dataset: i. Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. ii. Create a line chart to show the revenue based on the month of the year. iii. Create a bin of size 10 for the age measure to create a new dimension to show the revenue. iv. Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field. v. Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. vi. Create a calculated field to show the average revenue per state & display profitable & non-profitable state. vii) Build a dashboard.
8.	Analysis of GDP dataset: i. Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps. ii. Create a bar graph to compare GDP of Belgium between 2006 – 2026. iii. Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010. iv. Visualize the countries Bhutan & Costa Rica competing in terms of GDP v. Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006. vi. Build an interactive dashboard
9.	Analysis of HR Dataset: i. Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age. ii. Create a Lollipop Chart to show the attrition rate based on gender category. iii. Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label. iv. Create a bar chart to display the number of employees by Age group, v. Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count. vi. Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition – drag education field to rows, sum attrition count to col, vii. Create multiple donut chart to show the Attrition Rate by Gender for different Age group.
10.	Analysis of Amazon Prime Dataset: i. Create a Donut chart to show the percentage of movie and tv shows ii. Create a area chart to shows by release year and type iii. Create a horizontal bar chart to show Top 10 genre iv. Create a map to display total shows by country v. Create a text sheet to show the description of any movie/movies. vi. Build an interactive Dashboard.

Course Outcomes (Course Skill Set):

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

CO1: Design the experiment to create basic charts and graphs using Tableau and Power BI.

CO2: Develop the solution for the given real-world problem.

CO3: Analyse the results and produce substantial written documentation.

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.

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=g0m5sEHPU-s&list=PLUaB-1hjhk8HqnmK0gQhfmIdCbxwoAoys
- https://learn.microsoft.com/en-us/training/powerplatform/power-bi
- https://www.youtube.com/watch?v=SSq5NwsUNGI&list=PLEiEAq2VkUUJEvrsey26P-Bj4Vk6BLBVC
- https://www.tableau.com/learn/training

Computational Learning Theory			
Course Code	24AD55A	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Design and analysis of algorithms, basic computational complexity theory, mathematical maturity.

Course objectives:

- Understand the abilities and limitations of learning algorithms in well-defined learning model
- To Develop the core concepts and techniques of computational learning theory.
- To focus on algorithmic problems in supervised learning, Statistical Query Learning.
- To understand algorithms for learning Boolean functions from labeled examples in a number of models (including online mistake-bound learning, PAC learning, SQ learning, and learning with various types of noise).

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 **10 Hours**

WELL-POSED LEARNING PROBLEMS: A checkers learning problem, A handwriting recognition learning problem,A robot driving learning problem
DESIGNING A LEARNING SYSTEM: Choosing the Training Experience,Choosing the Target Function, Choosing a Representation for the Target Function, Choosing a Function Approximation Algorithm, The Final Design.
A CONCEPT LEARNING TASK: Concept learning, Notations
Textbook 1:Ch 1.1,1.2 , and Ch 2.1 and 2.2

MODULE-2 **10 Hours**

COMPUTATIONAL LEARNING THEORY: Introduction to Probably Approximately Correct Learning (PAC), Probably Learning An Approximately Correct Hypothesis, The Problem Setting, Error of a Hypothesis, PAC Learnability, Agnostic Learning and Inconsistent Hypotheses, Conjunctions of Boolean Literals Are PAC-Learnable , PAC-Learnability of Other Concept Classes, Sample Complexity For Finite Hypothesis Spaces, Sample Complexity For Infinite Hypothesis Spaces, Shattering a Set of Instances, The Vapnik-Chervonenkis (VC) Dimension, Sample Complexity and the VC Dimension.
THE MISTAKE BOUND MODEL OF LEARNING: Mistake Bound for the FIND-S Algorithm, Mistake Bound for the HALVING Algorithm, Optimal Mistake Bounds, WEIGHTED-MAJORITY Algorithm.
Textbook 1: Ch 7.1 to 7.5,

MODULE-3 **10 Hours**

Boosting : Weak Learnability, AdaBoost Algorithm, Bounding the Generalization Error
Statistical Query Learning: Random Classification Noise Model, Learning Conjunctions, Statistical Query Model
Textbook 2: Ch 4.1 and 4.2 and Ch 7.1 to 7.3

MODULE-4 **10 Hours**

Learning Real-valued Functions: Learning Real-Valued Functions, Realizable Setting, Non-Realizable Setting, A General Algorithmic Paradigm, Projected Gradient Descent for Lipschitz functions, Generalised Linear Models, Perceptron.
Mistake-Bounded Learning: Online Prediction Framework, The Winnow Algorithm
Textbook 2: Ch 8.1,8.2, 8.5 and 9.1, 9.4 and 9.5

MODULE-5 **10 Hours**

Online Learning with Expert Advice: Learning with Expert Advice, Follow The Leader, Application: Boosting Algorithm, Application: von Neumann's Min-Max Theorem
Textbook 3: Ch 10.1 to 10.5

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

1. Understand the theoretical limitations of learning and the trade-offs between sample complexity and computational complexity.
2. Analyze and define success metrics for learning algorithm.
3. Analyze and define AC (Probably Approximately Correct) learning, VC dimension.
4. Prove bounds on the number of mistakes in online learning (e.g., Perceptron/Winnow algorithms) and analyze algorithm convergence.

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 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. Machine Learning, Tom M. Mitchell, McGraw-Hill Science/Engineering/Math; (March 1, 1997), ISBN: 0070428077.
2. An Introduction to Computational Learning Theory, Michael J. Kearns and Umesh Vazirani, The MIT Press, August 15, 1994, ISBN: 9780262111935

REFERENCES:

1. M. Anthony and N. Biggs. *Computational Learning Theory*, Cambridge University Press, 1992.

2. Ethem Alpaydin, Introduction to Machine Learning, The MIT Press , 3rd Edition 2015

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=kCvTeckjkn0
- https://www.youtube.com/watch?v=X4Oxst5huQA
- https://www.youtube.com/watch?v=v-BsN-zKPcI
- https://www.youtube.com/watch?v=K8PUZtF8pZY
- https://www.youtube.com/watch?v=Ow25mjFjSmg
- https://www.youtube.com/watch?v=IHZwWFHWa-w

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

- Case Study
- Assignments
- Mini Project

Data Mining and Data Warehousing			
Course Code	24AD55B	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	4:0:0	**SEE Marks**	50
Total Hours of Pedagogy	50	**Total Marks**	100
Credits	04	**Exam Hours**	3
Examination type (SEE)	Theory		

Course objectives:

- Introduction to general issues of Data Warehouse and Data Mining.
- Understanding of the different architectures and mining techniques
- The role and functions of Data Warehouse and Data Mining
- Explain the stages and process different data mining techniques.
- Learn mining and warehouse techniques through the use of different tools

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**

Data Warehouse: Introduction to Data Ware House, Differences between operational database systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction Transformation-Loading, Logical (Multi- Dimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; Fact Less-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

Module-2 **10 Hours**

Introduction to Data Mining: Introduction, what is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing- Data Cleaning, Missing Data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of similarity and Dissimilarity-Basics.

Module 3	**10 Hours**
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.	
Module 4	**10 Hours**
Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.	
Module 5	**10 Hours**
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.	

Course Outcomes: At the end of the course students should be able to:

CO 1. Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
CO 2. Apply KDD process for finding interesting pattern from warehouse.
CO 3. Analyze the kinds of patterns that can be discovered by association rule mining.
CO 4. Evaluate interesting patterns from large amounts of data to analyze for predictions and classification.
CO 5. Design select suitable methods for data mining and analysis

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. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.

2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=m-aKj5ovDfg
- https://onlinecourses.swayam2.ac.in/cec19_cs01/preview
- http://nptel.ac.in/video.php?subjectId=106106093

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

- Course Project - Build a simple data warehouse using various schemas.

Business Intelligence			
Course Code	24AD55C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50 Hours	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Programming Skills
- Understanding of business needs
- Basic Mathematics
- Problem-Solving Skills

Course Objectives:

- Explain the Decision Support systems and Business Intelligence framework.
- Illustrate the significance of computerized Decision Support, and understand the mathematical modelling behind decision support.
- Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes. Explore knowledge management, explain its activities, approaches and its implementation.
- Describe the Expert systems, areas suitable for application of the expert's system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Use data visualization and dashboards
2. Demonstration of Analytical tools.
3. Chalk and board, power point presentations
4. Online material (Tutorials) and video lectures.

Module-1 **10 Hours**

Decision Support and Business Intelligence: Opening Vignette, Changing Business Environments and Computerized Decision Support, Managerial Decision Making, Computerized Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems (DSS), A framework for Business Intelligence (BI), A Work System View of Decision Support.

TB 1: Chapter 1

Module-2 **10 Hours**

Computerized Decision Support: Decision Making, Models, Phases of the Decision-Making Process, The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, How Decisions Are Supported.

Modelling and Analysis: Structure of Mathematical Models for Decision Support, Certainty,

Uncertainty, and Risk, Management Support Systems, Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking.

TB 1: Chapter 2

Module-3 **10 Hours**

Data Warehousing: Data Warehousing Definitions and Concepts, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes.

TB 1: Chapter 5

Module-4 **10 Hours**

Knowledge Management: Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation.

TB 1: Chapter 11

Module-5 **10 Hours**

Expert Systems: Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Problem Areas Suitable for Expert Systems, Development of Expert Systems, Benefits, Limitations, and Critical Success Factors of Expert Systems.

TB 1: Chapter 12

Course outcomes (Course Skill Set):

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

CO1: Apply the basics of data and business to understand Decision Support systems and Business Intelligence framework.

CO2: Describe the significance of 98 Computerized Decision Support, apply the basics of mathematics to understand the mathematical modelling behind decision support.

CO3: Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes.

CO4: Analyze the importance of knowledge management and explain its activities, approaches and its implementation.

CO5: Describe the Expert systems and analyze its development, discuss areas suitable for application of the expert's system.

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 marks 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 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. Business Intelligence and Analytics: Systems for decision support, Ramesh Sharda, Dursun Delden, Efraim Turban, Pearson Tenth edition

Reference Books:

1. Data Mining Techniques. For Marketing, Sales and Customer Relationship Management Berry M.& Linoff G. Wiley Publishing Inc 2004
2. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly Media, Inc2013

Web links and Video Lectures(e-Resources):

- https://www.coursera.org/learn/business-intelligence-essentials
- https://www.coursera.org/professional-certificates/google-business-intelligence
- https://www.udemy.com/course/business-data-analysis-using-microsoft-power-bi/?couponCode=PMNVD2025
- https://onlinecourses.nptel.ac.in/noc26_cs64/preview

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

- **Data Visualization & Dashboards:** Developing interactive dashboards using Tableau, Power BI, or Excel to translate raw data into actionable insights.
- **Case Studies & Real-World Projects:** Analyzing real-world business scenarios to apply predictive modeling, data mining, and statistical analysis to solve complex problems.

CLOUD COMPUTING			
Course Code	24AD55D	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	4:0:0	**SEE Marks**	50
Total Hours of Pedagogy	50	**Total Marks**	100
Credits	03	**Exam Hours**	3
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	**10 Hours**

Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.

Textbook 1: Chapter 1: 1.1 to 1.5

Module-2	**10 Hours**

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

Textbook 1: Chapter 3: 3.1 to 3.5

Module-3	**10 Hours**
Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure. **Textbook 1: Chapter 4: 4.1 to 4.4**	
Module-4	**10 Hours**
Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor. **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	**10 Hours**
Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments. **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:

CO1: Describe various cloud computing platforms and service providers.

CO2: Illustrate the significance of various types of virtualization.

CO3: Identify the architecture, delivery models and industrial platforms for cloud computing based applications.

CO4: Analyze the role of security aspects in cloud computing.

CO5: Demonstrate cloud applications in various fields using suitable cloud platforms.

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.

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://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
- Implement cloud applications using GAE, AWS, Azure/simulate cloud applications using Cloudsim/ Greencloud/ Cloud Analyst etc

Computer Vision			
Course Code	24AD56A	**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 nature (SEE)	Theory		

Course objectives:

- To understand the fundamentals of computer vision and digital image processing.
- To introduce the processes involved image enhancement and restoration.
- To facilitate the students to gain understanding color image processing and morphology.
- To impart the knowledge of image segmentation and object recognition techniques.

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. Use animations/videos to help the students to understand the concepts.
7. Demonstrate the concepts using a suitable programming language.

MODULE-1 **10 Hours**

Introduction: What is computer vision? A brief history. Image Formation: Photometric image formation, The digital camera. Image processing: Point operators, Linear filtering.
Textbook-1: Chap-1 (1.1, 1.2), Chap-2 (2.2, 2.3), Chap-3 (3.1, 3.2)

MODULE-2 **10 Hours**

Image processing: More neighborhood operators, Fourier transforms, Pyramids and wavelets, and Geometric transformations.
Textbook-1: Chap- 3 (3.3 - 3.6)

MODULE-3 **10 Hours**

Image Restoration and Reconstruction: A model of Image degradation/restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering. Image Segmentation: Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only), Segmentation by region growing & region splitting & merging.
Textbook-2: Chap-5 (5.1 to 5.4), Chap-10 (10.1 to 10.3.2, 10.4)

MODULE-4 **10 Hours**

Color Image Processing: Color fundamentals, color models, Pseudocolor image processing, full color image processing, color transformations, color image smoothing and sharpening, Using color in image segmentation, Noise in color images.
Textbook-2: Chap-6 (6.1-6.8)

MODULE-5 **10 Hours**

Morphological Image Processing: Preliminaries, Erosion and Dilation, opening and closing, Hit-or miss transform, some basic morphological algorithms.

Feature Extraction: Background, Boundary preprocessing (Boundary following & Chain codes only).
Image pattern Classification: Background, Patterns and classes, Pattern classification by prototype matching (Minimum distance classifier only).
Textbook-2: Chap -9 (9.1-9.5), Chap-11(11.1-11.2.2), Chap-12 (12.1-12.3.1)

PRACTICAL COMPONENT

Sl.No.	Experiments
1	Installation of OpenCV and demonstration of basic image operations such as reading, displaying, saving, resizing, and cropping an image.
2	Implementation of image thresholding techniques and color space conversions (RGB to Grayscale and RGB to HSV).
3	Application of image filtering techniques (Gaussian, Median, Bilateral) and histogram equalization for image enhancement.
4	Detection of edges using Sobel and Canny operators and extraction of contours from an image.
5	Extraction of image features using ORB or SIFT feature detectors and visualization of keypoints.
6	Implementation of geometric image transformations including translation, rotation, scaling, and affine transformation.
7	Image segmentation using the GrabCut algorithm.
8	Face detection using the Haar Cascade classifier.
9	Motion detection in video using frame differencing or background subtraction techniques.
10	Development of a mini project for object detection using a pre-trained deep learning model (e.g., YOLO or MobileNet-SSD).

Course outcome (Course Skill Set):

At the end of the course, the student will be able to:
1. Explain the fundamentals of computer vision and its applications.
2. Apply the image enhancement techniques for smoothing and sharpening of images.
3. Compare the different image restoration and segmentation techniques.
4. Demonstrate the smoothing and sharpening techniques for color images.
5. Explain morphological, feature extraction, and pattern classification techniques for object recognition.

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 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 otherassessment 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.

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. Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2nd Edition, 2022, Springer.

2. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Pearson, 4th edition, 2019.

REFERENCES:

1. David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.

2. Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

Web links and Video Lectures (e-Resources):

- Virtual Labs: https://cse19-iiith.vlabs.ac.in/
- https://onlinecourses.nptel.ac.in/noc21_ee78/preview
- Introduction to Machine Vision: https://www.youtube.com/watch?v=tY2gczObpfU
- https://coral.ise.lehigh.edu/optml/files/2019/10/OptML_CV_tutorial_1_compressed.pdf

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

- Programming Assignment-1: Implementation of important concepts of Image enhancement (point & filters) and restoration techniques with C++/Java/Python - 10 Marks
- Programming Assignment-2: Implementation of segmentation, Morphological and color image processing techniques with C++/Java/Python - 15 Marks

INFORMATION RETRIEVAL			
Course Code	24AD56B	**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 nature (SEE)	Theory		

Course objectives:

- Understand the need of an information retrieval system.
- Understand various retrieval models and the factors of evaluation.
- Explore on text, query and indexed based processing for information retrieval.
- Realize the importance of user interfaces for visualization and the web based search.

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 **10 Hours**

Introduction:
Information retrieval, IR problem, IR System, The web.
User interfaces for search:
Introduction, How people search, Search interfaces today, Visualization on search interfaces, Design and evaluation of search interfaces.

Textbook: Chapter 1: 1.1 to 1.4, Chapter 2: 2.1 to 2.5

MODULE-2 **10 Hours**

Modeling:
IR models, Classic information retrieval, Alternative set theoretic models, Alternative algebraic models, Alternative probabilistic models, Other models.
Textbook: Chapter 3: 3.1 to 3.6 .

MODULE-3 **10 Hours**

Retrieval Evaluation:
Retrieval metrics, Reference Collections, User-based evaluation
Relevance feedback and Query expansion: A framework for feedback methods, Explicit relevance feedback, Explicit feedback through clicks, Implicit feedback through local analysis, Implicit feedback through global analysis.
Documents - Languages and Properties: Metadata, Document formats, Text properties, Document preprocessing, Organizing documents, Text compression
Textbook : Chapter 4: 4.3 to 4.5, Chapter 5: 5.2 to 5.6, Chapter 6: 6.2 to 6.3, 6.5 to 6.8

MODULE-4 **10 Hours**

Indexing and Searching:
Inverted indexes, Signature files, Suffix trees and suffix arrays, Sequential searching, Multi-dimensional indexing.
Textbook: Chapter 9: 9.2 to 9.6

MODULE-5 **10 Hours**

Web retrieval: The web, Search engine architectures, Search engine ranking, Managing web data, Search engine user interaction.

Structured Text Retrieval: Structuring Power, Early text retrieval models, XML retrieval, XML retrieval evaluation.
Textbook: Chapter 11: 11.2 to 11.7, Chapter 13: 13.2 to 13.5.

PRACTICAL COMPONENT

Sl.No.	Experiment
1	Implementation of Conflation Algorithm
2	Implementation of Single Pass Algorithm for Clustering
3	Implementation of Inverted Files
4	Implementation of feature extraction from 2D image
5	Implementation of Web Crawler
6	Implementation of feature extraction from input image and plot histogram for th features
7	Implementation of Retrieval-Augmented Generation (RAG) for Information Retrieva
8	Implementation of Information Retrieval System using Large Language Models (LLM and LangChain

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

1. Identify the models and the tools for building an Information Retrieval system.
2. Apply query based operations for information retrieval.
3. Use of text based operations for information retrieval from the documents.
4. Apply indexing and searching techniques for information retrieval.
5. Design user interface for search and retrieval of information from the web/documents

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 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 otherassessment 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.

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:

Text Books:

1. Ricardo BaezaYates and BerthierRibeiroNeto, Modern Information Retrieval, 2nd Edition, Pearson 2011

Reference Books:

1. . Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. . Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer, 2nd Edition, 2002 3. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=cv7ztWiIaAM
- https://www.youtube.com/watch?v=ecRMy60oBrA
- https://www.youtube.com/watch?v=dXHxPvAIwcI
- https://www.youtube.com/playlist?list=PLpwnR8mPhhf8m7L_b9cSRLdjPW2soerAd
- https://www.youtube.com/watch?v=m0oiAOgSQFw

- https://www.youtube.com/watch?v=yluvahNq3wk

EXPLORATORY DATA ANALYSIS			
Course Code	24AD56C	**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 nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- **Python Programming**

Course objectives:

- To equip students with Python, IPython, and Jupyter for data analysis tasks.
- To provide a comprehensive understanding of NumPy for scientific computations.
- To introduce foundational and advanced data manipulation techniques using Pandas
- To enhance data visualization skills using Matplotlib and Seaborn
- To introduce Machine Learning concept with practical applications using Scikit-Learn.
- To promote the practical application of data analysis tools and techniques on real-world datasets

Teaching-Learning Process (General Instructions)

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/Demonstration 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. Use animations/videos to help the students to understand the concepts.
7. Demonstrate the concepts using PYTHON and its libraries

MODULE-1 **10 Hours**

Introduction to Python and NumPy: Getting Started in IPython and Jupyter, Enhanced Interactive Features, The Basics of NumPy Arrays, Sorted Arrays, Structured Data: NumPy's Structured Arrays

Textbook: Chapter 2, Chapter 5, Chapter 11, Chapter 12, Chapter 1(Not for CIE/SEE),

MODULE-2 **10 Hours**

Data Manipulation with Pandas - I: Introducing Pandas Objects, Handling Missing Data, Hierarchical Indexing, Pivot Tables.

Textbook: Chapter 13, Chapter 16, Chapter 17, Chapter 21

MODULE-3 **10 Hours**

Data Manipulation with Pandas - II: Vectorized String Operations, Working with Time Series, HighPerformance Pandas: eval and query

Textbook: Chapter 22, Chapter 23, Chapter 24

MODULE-4 **10 Hours**

Data Visualization with MatPlotlib: General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualization with Seaborn

Textbook: Chapter 25, Chapter 26, Chapter 27, Chapter 36

MODULE-5 **10 Hours**

Introduction to Machine Learning: What Is Machine Learning?, Introducing Scikit-Learn, Hyperparameters and Model Validation

Textbook: Chapter 37, Chapter 38, Chapter 39

PRACTICAL COMPONENT

Sl. No.	Experiment
1	Program to get Statistical characteristics of dataset using Pandas
2	Program for analysis of data through different visualisations (scatter plot, bubble plot, stacked chart, bar chart, pie chart and histogram)
3	Implementation of data transformation-reshaping and de-duplication of data.
4	Implementation of data transformation-Handling missing data, filling missing data
5	Program on discretization and binning of data
6	Program to handle missing values
7	Program to implement different distribution (normal, poisson, uniform and gamma)
8	Program to implement descriptive statistics (variance, skewness, kurtosis, percentil

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

1. Demonstrate the application of the NumPy for performing data analysis tasks.
2. Make use of Pandas for various data manipulation tasks.
3. Apply advanced data manipulation techniques to real-world datasets.
4. Develop data visualizations using Matplotlib and Seaborn to effectively communicate data insights.
5. Explain the fundamental concepts of machine learning and validation models using Scikit-Learn.

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 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 otherassessment 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.

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:

Text Books:

1. Jake VanderPlas - Python Data Science Handbook: Essential Tools for Working with Data, Oreilly 2nd Edition, 2022.

Reference Book:

2. https://python4csip.com/files/download/Data%20Visualization.pdf

Numpy Tutorial - https://www.w3schools.com/python/numpy/default.asp

- **Pandas Tutorial - https://www.w3schools.com/python/pandas/default.asp**
- **Matplotlib Tutorial - https://www.w3schools.com/python/matplotlib_intro.asp**
- **Introduction to ML with Scikit Learn - https://scikit-learn.org/1.4/tutorial/basic/tutorial.html**

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

- Programming Assignment-1: Implementation of important concepts of data manipulation using NumPy and Pandas (Python) - 10 Marks
- Programming Assignment-2: Implementation of simple Machine Learning models with Visualization using Python (MatPlotlib, Scikitlearn) - 15 Marks

Digital Image Processing			
Course Code	24AD56D	**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 nature (SEE)	Theory		

Prerequisite:

The students should have knowledge on

- Discrete Mathematics

Course objectives:

- Understand the fundamentals of digital image processing
- Explain the image transform techniques used in digital image processing.
- Apply different image enhancement techniques on digital images
- Evaluate image restoration techniques and methods used in digital image processing.
- Understand the morphological operations and segmentation used in digital image processing.

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 **10 Hours**

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

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

MODULE-2 **10 Hours**

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

Textbook 1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to 4.10

MODULE-3 **10 Hours**

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering and Constrained Least Squares Filtering.

Textbook 1: Chapter 5: Sections 5.2 to 5.9

MODULE-4 **10 Hours**

Color Image Processing: Color Fundamentals, Color Models, and Pseudo-color Image Processing.

Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some

Basic Morphological Algorithms.
Textbook 1: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2, Chapter 9: Sections 9.1 to 9.5 (Rafael C. Gonzalez & Richard E. Woods)

MODULE-5 **10 Hours**

Segmentation: Introduction, Classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, Principles of Thresholding. Representation and Description: Representation, Boundary descriptors.
Textbook 3: *Chapter 9: Sections 9.1 to 9.7* and *Chapter 11: Sections 11.1 and 11.2* (Rafael C. Gonzalez & Richard E. Woods)

PRACTICAL COMPONENT

Sl.No.	**Experiment**
1	Create an openCV-Python program to get a gradient image from an RGB/grayscale image.
2	Create an openCV-Python program to show a histogram for the RGB/grayscale image.
3	Create an openCV-Python program to convert a given RGB/grayscale image to a negative image.
4	Create an openCV-Python program to enhance brightness of a given RGB/grayscale image.
5	Create an openCV-Python program to segment a given RGB/grayscale image based on threshold.
6	Create an openCV-Python program to segment a given RGB/grayscale image based on contour-detection algorithm.
7	Create an openCV-Python program to smoothen a given RGB/grayscale image using a 2D filter.
8	Create an openCV-Python program to smoothen a given RGB/grayscale image using a Gaussian filter.

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

1. Understand the fundamentals of Digital Image Processing. (PO – 1,2,3; PSO – 1,2)
2. Apply different image transformation techniques. (PO – 1,2,3,4; PSO – 1,2)
3. Analyze various image restoration techniques. (PO – 1,2,4; PSO – 1,2)
4. Understand colour image and morphological processing. (PO – 1,2,3; PSO – 1,2)
5. Design image analysis and segmentation techniques. (PO – 1,2,4,5; PSO – 1,2)

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 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 otherassessment 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.

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. **Rafael C. Gonzalez and Richard E. Woods**, *Digital Image Processing*, Third Edition, Prentice Hall.
2. **S. Sridhar**, *Digital Image Processing*, Oxford University Press, Second Edition, 2016.

REFERENCES:

1.**S. Jayaraman, S. Esakkirajan, T. Veerakumar**, *Digital Image Processing*, Tata McGraw Hill, 2014.

2.A. K. Jain, *Fundamentals of Digital Image Processing***,** Pearson, 2004.

Web links and Video Lectures (e-Resources):

Sure! Here are the direct links:

- https://nptel.ac.in/courses/117105079 (Intro to Digital Image Processing)
- https://nptel.ac.in/courses/108103174 (Computer Vision & Image Processing)
- https://in.mathworks.com/solutions/image-video-processing.html

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

- Case Study
- Assignments
- Mini Project

ENVIRONMENTAL STUDIES AND E WASTE MANAGEMENT (CSE AND ALLIED BRANCH ONLY)			
Course Code	24ES57	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	1:0:0:0	**SEE Marks**	-
Credits	-	**Total Marks**	100
Contact Hours	14	**Exam Hours**	-
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on:

- Understanding of Ecosystems and Sustainability
- Awareness of Environmental Issues
- Familiarity with Environmental Legislation
- Basic Scientific Principles
- Knowledge of E-waste Lifecycle
- Familiarity with E-waste Recycling Methods
- Awareness of Environmental Policies

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)

Teachers can use following strategies 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 analyse information rather than simply recall it.

Module-1	**2 hrs**
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. **L1, L2** **Text Book 1**: CH- 3, e-resource:1	
Module-2	**2hrs**
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 **L1, L2** **Textbook 1**: CH- 2	
Module-3	**2 hrs**
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 **L1, L2** **Textbook 1:** CH- 5	
Module-4	**2 hrs**
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 **L1, L2** **Textbook 1**: CH- 6, e-resource:2	
Module-5	6 hrs
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 **L1, L2** **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:

CO1: Comprehend the principles of ecology and environmental issues pertaining to air, land, and water on a global scale. (PO – 1,2,3,4,6,7)

CO2: Acquire observation skills for solving problems related to the environment. (PO – 1,2,3,4,6,7)

CO3: Conduct survey to describe the realities of waste management system. (PO – 1,2,3,4,5,6,7)

CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues (PO – 1,2,3,4,5,6,7 PSO – 1)

CO5: Understand the sources, types, and composition of electronic waste and its impact on the environment and human health. (PO – 1,2,3,4,5,6,7)

Assessment Details

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

Continuous Internal Evaluation:

- There are 50 marks for the CIE's Assignment component and 50 for the Internal Assessment Test component.
- Each test shall be conducted for 50 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 50 marks
- 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 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. The final CIE marks of the course out of 100 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.

YOGA			
Course Code	24YO58	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	0
Credits	0	**Total Marks**	100
Contact Hours	20-24	**Exam Hours**	
Examination type (SEE)	Practical		

Module-1 **3 Hours**

Ashtanga Yoga: Patanjali's Ashtanga Yoga its need and importance.

1. Asana
2. Pranayama
3. Pratyahara

Module-2 **3 Hours**

Suryanamaskara: Suryanamaskar 12 count 6 rounds

Module-3 **3 Hours**

Asanas: Asana, Need, importance of Asana. Different types of asanas. Asana its meaning by name, technique, precautionary measures and benefits of each asana.

Different types of Asanas

1. Sitting
    a. Ardha lJshtrasana
    b. Vakrasana
    c. Yogamudra in Padmasana
2. Standing
    a. I.Jrdhva Hastothanasana
    b. Hastapadasana
    c. Parivritta Trikonasana
    d. Ljtkatasana
3. Supine line
    a. Sarvangasana
    b. Chakraasana
    c. Pavanamuktasana

Module-4 **3 Hours**

Kapalabhati: Revision of practice 60 strokes/min 3 rounds

Module-5 **3 Hours**

Pranayama – Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

Different types of Pranayama

l. Ujjayi

2. Sheetali

3. Sheektari

NATIONAL SERVICE SCHEME (NSS)			
Course Code	24NS58	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**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: National Service Scheme (NSS) will enable the students to:

- Understand the community in general in which they work.
- Identify the needs and problems of the community and involve them in problem –solving.
- Develop among themselves a sense of social & civic responsibility & utilize their knowledge
- in finding practical solutions to individual and community problems.
- 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.

General Instructions - Pedagogy :

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

- 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.
- State the need for NSS activities and its present relevance in the society and Provide real-life examples.
- Support and guide the students for self-planned activities.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- 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/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**
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 issues.
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. Foreg. 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	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.

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.

1. **Evaluation Of the Topic** Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2. **Activity Report:** Report should be submitted by individual to the concerned evaluation authority
3. **Team Size:** May be individual or team

Sl No	Topic	Location	Activity execution
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	Farmers land/Villages/ roadside/ community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
2.	Waste management– Public, Private and Govt organization, 5 R's.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board
4.	Water conservation techniques – Role of different stakeholders– Implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board

7.	Developing Sustainable Water management system for rural areas and implementation approaches.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board
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.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
10.	Plantation and adoption of plants. Know your plants.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
11.	Organize National integration and social harmony events /workshops/seminars. (Minimum 02 programs).	Villages/ City Areas Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board

PHYSICAL EDUCATION (SPORTS & ATHLETICS)			
Course Code	24PE58	**CIE Marks**	**100 Marks**
Teaching Hours/Week (L: T: P)	0:0:2		
Examination type (SEE)	24P		

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, Food, Nutrition and general 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. Understand and practice of specific games and athletic throwing events.

Module I : Orientation **4 Hours**

A. Fitness
B. B. Food & Nutrition

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

A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

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

A. Badminton (Fore hand low/high service, back hand service, smash, drop)
B. Basketball (Dribbling, passing, shooting etc.)
C. 3. Athletics (Field events – Throws)

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

MACHINE LEARNING			
Course Code	24AD61	**CIE Marks**	50
Teaching Hours/Week(L:T:P)	3:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	03
Examination type(SEE)	Theory		

Course objectives:

- To introduce the fundamental concepts and techniques of machine learning.
- To understand various types of machine learning and the challenges faced in real-world applications.
- To familiarize the machine learning algorithms such as regression, decision trees, Bayesian models, clustering, and neural networks.
- To familiarize students with advanced clustering methods beyond basic clustering algorithms.
- To enable students to model and evaluate machine learning solutions for different types Of problems.

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 / Demonstration 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 / Practical Based Learning (PBL), which fosters students' analytical skills, develop design thinking skills, and practical skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Use animations / videos to help the students to understand the concepts.
7. Demonstrate the concepts using PYTHON and its libraries wherever possible.

Module-1 **8 Hours**

Introduction: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications.

Understanding Data 1: Introduction, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization.

Text book -1->Chapter-1,2(2.1-2.5)

Module-2 **8 Hours**

UnderstandingData–2: Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Feature Engineering and Dimensionality Reduction Techniques.

Basic Learning Theory: Design of Learning System, Introduction to Concept of Learning, Modelling in Machine Learning.

Text book -1->Chapter-2(2.6-2.8,2.10),Chapter-3(3.3,3.4,3.6)

Module-3 **8 Hours**

Similarity-based Learning: Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

Regression Analysis: Introduction to Regression, Introduction to Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression.

Decision Tree Learning: Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms.

Text book -1->Chapter-4(4.2-4.5),Chapter-5(5.1-5.3,5.5-5.7),Chapter-6(6.1,6.2)

Module-4 **8 Hours**

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model, Naïve Bayes Algorithm for Continuous Attributes.

Artificial Neural Networks: Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Networks, Popular Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of ANN.

Text book -1->Chapter-8(8.1-8.4),Chapter-10(10.1-10.5,10.9-10.11)

Module-5 **8 Hours**

Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach.

Advanced Clustering Techniques: OPTICS and HDBSCAN as extensions of DBSCAN, Gaussian Mixture Models using EM Algorithm, Concept of Fuzzy Clustering.

Text book -1->Chapter-13(13.1-13.6),Chapter-14(14-1-14.10)

Text book -2-> Chapter-8 (8.1-8.3)

Course outcome(Course Skill Set)

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

1. Describe the machine learning techniques, their types and data analysis framework.
2. Apply mathematical concepts for feature engineering and perform dimensionality reduction to enhance model performance.
3. Develop similarity-based learning models and regression models for solving classification and prediction tasks.
4. Build probabilistic learning models and design neural network models using perceptrons and multilayer architectures.
5. Utilize clustering algorithms, including advanced density-based and probabilistic clustering techniques, to identify meaningful patterns in complex datasets.

Assessment Details (both CIE and SEE)

The weight age 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(20marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks(18out 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%(40marks 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:

Books

1. S Sridhar, M Vijayalakshmi, "Machine Learning", OXFORD University Press 2021, First Edition.
2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar, *Introduction to Data Mining*, Pearson, 2nd Edition.

Reference Books

1. Murty, M. N., and V. S. Anantha narayana. *Machine Learning: Theory and Practice*, Universities Press, 2024.
2. T. M. Mitchell, *Machine Learning*, McGraw Hill, 1997.
3. Burkov, Andriy. *The Hundred-Page Machine Learning Book*. Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019.

Web links and Video Lectures(e-Resources):

- **https://www.universitiespress.com/resources?id=9789393330697**
- https://www.drssridhar.com/?page_id=1053
- Machine Learning Tutorials:https://www.geeksforgeeks.org/machine-learning/
- Machine Learning Tutorials:https://www.tutorialspoint.com/machine_learning/index.htm
- Python for Machine Learning:https://www.w3schools.com/python/python_ml_getting_started.asp
- Introduction to Machine Learning:https://onlinecourses.nptel.ac.in/noc22_cs29/preview

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

- Practical Assignment: Implementation of Practical Exercises Chapter 2: Q1–Q4, Chapter 3: Q1, Chapter 4: Q1, Chapter 7: Q1, Chapter 8: Q1 – 10 Marks.
  (Note: Refer to Reference book 1 for programming assignments https://www.universitiespress.com/resources?id=9789393330697)
- Course project: By considering suitable machine learning-based real world application problem [15 Marks].

Big Data Analytics			
Course Code	24AD62	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	40 Hours Theory + 8-10 Lab slots	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Solid foundation in programming
- Basic understanding of big data
- Strong Mathematics / Statistical knowledge
- Knowledge on SQL and database management.

Course Objectives:

- To implement MapReduce programs for processing big data.
- To realize storage and processing of big data using MongoDB, Pig, Hive and Spark.
- To analyze big data using machine learning techniques

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

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.

Module-1 **8 Hours**

Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment.

Big Data Analytics: What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop.

TB1: Ch 1: 1.1, Ch2: 2.1-2.5,2.7,2.9-2.11, Ch3: 3.2,3.5,3.8,3.12, Ch4: 4.1,4.2

Module-2 **8 Hours**

Introduction to Hadoop: Introducing hadoop, Why hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System), Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator).

Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner,

Searching, Sorting, Compression.

TB1: Ch 5: 5.1-,5.8, 5.10-5.12, Ch 8: 8.1 - 8.8

Module-3 **8 Hours**

Introduction to MongoDB: What is MongoDB, Why MongoDB, Terms used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

TB1: Ch 6: 6.1-6.5

Module-4 **8 Hours**

Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).
Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

TB1: Ch 9: 9.1-9.6,9.8, Ch 10: 10.1 - 10.15, 10.22

Module-5 **8 Hours**

Spark and Big Data Analytics: Spark, Introduction to Data Analysis with Spark.
Text, Web Content and Link Analytics: Introduction, Text Mining, Web Mining, Web Content and Web
Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph.

TB2: Ch5: 5.2,5.3, Ch 9: 9.1-9.4

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments (Java/Python/R)
1	Install Hadoop and Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files and directories. **Hint:** A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.
2	Develop a MapReduce program to implement Matrix Multiplication
3	Develop a Map Reduce program that mines weather data and displays appropriate messages indicating the weather conditions of the day.
4	Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.
5	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB

6	Develop Pig Latin scripts to sort, group, join, project, and filter the data.
7	Use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
8	Implement a word count program in Hadoop and Spark.
9	Use CDH (Cloudera Distribution for Hadoop) and HUE (Hadoop User Interface) to analyze data and generate reports for sample datasets

Course outcomes (Course Skill Set):

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

CO1: Identify and list various Big Data concepts, tools and applications.

CO2: Develop programs using HADOOP framework.

CO3: Make use of Hadoop Cluster to deploy Map Reduce jobs, PIG, HIVE and Spark programs.

CO4: Analyze the given data set and identify deep insights from the data set.

CO5: Demonstrate Text, Web Content and Link Analytics.

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

- **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 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. Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2. Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.

Reference Books:

1. Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
3. Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition.

Web links and Video Lectures(e-Resources):

- https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
- https://www.youtube.com/watch?v=bAyrObl7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
- https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&index=4
- https://www.youtube.com/watch?v=GG-VRm6XnNk
- https://www.youtube.com/watch?v=JglO2Nv_92A

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

- Implement MongoDB based application to store big data for data processing and analyzing the results

Machine Learning Lab			
Course Code	24AD63	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	01	**Total Marks**	100
Contact Hours	24	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge of

- Python
- Data Structures and Algorithms
- Probability and Statistics
- Linear Algebra

Course Objectives:

- To become familiar with data and visualize univariate, bivariate, and multivariate data using statistical techniques and dimensionality reduction.
- To understand various machine learning algorithms such as similarity-based learning, regression, decision trees, and clustering.
- To familiarize with learning theories, probability-based models and developing the skills required for decision-making in dynamic environments.

Teaching-Learning Process (General Instructions)

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

1. Demonstration based teaching
2. ICT based learning using Simulation and Tools
3. Problem Based Learning

S. No	Experiments
1.	Develop a program to create histograms for all numerical features and analyze 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 $x_i \in$ Class 1, else $x_i \in$ 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: Illustrate the principles of multivariate data and apply dimensionality reduction techniques. (PO – 1,2,3,5,8,9,11, PSO – 1,2)

CO2: Demonstrate similarity-based learning methods and perform regression analysis. (PO – 1,2,3,5,8,9,11, PSO – 1,2)

CO3: Develop decision trees for classification and regression problems, and Bayesian models for probabilistic learning. PO – 1,2,3,5,8,9,11, PSO – 1,2)

CO4: Implement the clustering algorithms to share computing resources. (PO – 1,2,3,5,8,9,11, PSO – 1,2)

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 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 Examination:

- 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. S Sridhar and M Vijayalakshmi, “Machine Learning”, Oxford University Press, 2021.
2. M N Murty and Ananthanarayana V S, “Machine Learning: Theory and Practice”, Universities Press (India) Pvt. Limited, 2024.

Web links and Video Lectures (e-Resources):

1. https://www.drssridhar.com/?page_id=1053
2. https://www.universitiespress.com/resources?id=9789393330697
3. https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Human-Centred AI			
Course Code	24AD65A	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination nature (SEE)	Theory		

Course objectives:

- To understanding of the foundational principles of Human-Centered AI
- To learn and evaluate reliable, safe, and trustworthy AI systems using the HCAI framework
- To understand governance strategies that bridge the gap between ethical principles and practical steps
- To learn how to create and assess safety cultures in organizations through management strategies, incident reporting, and trustworthy certification practices
- To understand how AI can amplify human-to-human communication and cooperation

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 **10 Hours**

What Is Human-Centered Artificial Intelligence: Introduction, Are People and Computers in the Same Category?, Will Automation, AI, and Robots Lead to Widespread Unemployment?

Textbook: Chapter 1, Chapter 3, Chapter 4

MODULE-2 **10 Hours**

Human-Centered Ai Framework:
Introduction, Defining Reliable, Safe, and Trustworthy Systems, Two-Dimensional HCAI Framework, Design Guidelines and Examples

Textbook: Chapter 6, Chapter 7, Chapter 8, Chapter 9

MODULE-3 **10 Hours**

Design Metaphors:
Introduction, Science and Innovation Goals, Intelligent Agents and Supertools, Teammates and Tele-bots, Social Robots and Active Appliances

Textbook: Chapter 11, Chapter 12, Chapter 13, Chapter 14, Chapter 16

MODULE-4 **10 Hours**

Governance Structures – 1: Introduction, Reliable Systems Based on Sound Software Engineering Practice, Safety Culture through Business Management Strategies, Trustworthy Certification by Independent Oversight

Textbook: Chapter 18, Chapter 19, Chapter 20, Chapter 21

MODULE-5 **10 Hours**

Governance Structures – 2:

Government Interventions and Regulations, Introduction: Driving HCAI Forward, Assessing Trustworthiness, Caring for and Learning from Older Adults.
Textbook: Chapter 22, Chapter 24, Chapter 25, Chapter 26,

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

1. Demonstrate a foundational of Human-Centered AI with human values such as rights, dignity, and justice.
2. Apply the Human-Centered AI framework to design AI systems that achieve high levels of both human control and automation
3. Utilize design metaphors (supertools and tele-bots) to innovate and develop AI applications that enhance human creativity
4. Develop governance structures and ethical strategies to ensure the safe and responsible deployment of AI systems .
5. Identify emerging trends and challenges in Human-Centered AI and Design strategies for enhancing trustworthiness and societal benefits.

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 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

1. Shneiderman, Ben. Human-centered AI. Oxford University Press, 2022.

Reference Book

1. Nam, Chang S., Jae-Yoon Jung, and Sangwon Lee, eds. Human-Centered Artificial Intelligence: Research and Applications. Academic Press, 2022.
2. Chetouani, Mohamed, et al., eds. Human-centered artificial intelligence: Advanced lectures. Vol. 13500. Springer Nature, 2023.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=HcCZSw-Rm-w

Natural Language Processing			
Course Code	24AD65B	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**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.

1.

MODULE-1 **10 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 **10 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 **10 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 **10 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 **10 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.

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.
● Model morphological analysis using Finite State Transducers and parsing using context-free grammar and different parsing approaches.
● Develop the Naïve Bayes classifier and sentiment analysis for natural language problems and text classifications.
● Apply the concepts of information retrieval, lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, distributional word similarity.
● Identify the Machine Translation applications of NLP using Encoder and Decoder.

Assessment Details (both CIE and SEE):

The weight age 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 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. 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*, Apress, 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):

Sure! 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**

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.

Blockchain Technology			
Course Code	24AD65C	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	4:0:0	**SEE Marks**	50
Contact Hours	50	**Total Marks**	100
Credits	04	**Exam Hours**	03
Examination type (SEE)	Theory		

Course objectives:

- To Understand Blockchain terminologies with its applications. design
- To learn working principles of Blockchain and methodologies used in Bitcoin
- To gain knowledge on Ethereum Network, Wallets, Nodes, Smart contract & DApps
- To learn blockchain Based Application Architecture using Hyperledger and the Smart Contract Lifecycle

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/Demonstration 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. Use animations/videos to help the students to understand the concepts.

Module-1 **10 Hours**

Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Chapter 1

Module-2 **10 Hours**

Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization.

Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, Second pre-image resistance, Collision resistance, Message Digest (MD), Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDS).

Chapter 2, Chapter 3

Module-3 **10 Hours**

Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction

structure, Types of transaction, The structure of a block, The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a blockchain, The DAO.

Chapter 4, Chapter 6

Module-4 **10 Hours**

Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum blockchain , Ethereum virtual machine (EVM), Accounts, Block, Ether, Messages, Mining, The Ethereum network.

Hands-on: Clients and wallets –Geth.

Chapter 7

Module-5 **10 Hours**

Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda.

Chapter 9

Course outcomes (Course Skill Set)

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

1. Explain the Blockchain terminologies with its applications. design
2. Illustrate the working principles of Blockchain and the Smart Contract Lifecycle
3. Demonstrate the principles and methodologies used in Bitcoin
4. Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps.
5. Make use of Hyperledger in Blockchain Based Application Architecture.

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:

Books

1. Imran Bashir. "Mastering BlockChain", Third Edition, Packt – 2020.

Reference Book

1. Andreas M , Mastering Bitcoin: Programming the Open Blockchain – O'rielly – 2017.
2. Andreas M. Antonopoulos, Gavin Wood, Mastering Ethereum - O'rielly - 2018

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106104220
- https://www.geeksforgeeks.org/blockchain/
- https://www.tutorialspoint.com/blockchain/index.htm

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

- Course Project: Covers the implementation of the major concepts outlined in the syllabus– 25 Marks

Time Series Analysis			
Course Code	24AD65D	**CIE Marks**	50
Teaching Hours/Week (L: T:P)	4:0:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on

- Basic Statistics
- Linear Algebra
- Calculus
- Probability

Course Objectives:

- Learn the importance of time series analysis on the data.
- Identify approaches to handle linear stationary and non stationary models.
- Analyse ways of model building and parameter estimation.
- Recognize methods to handle multivariate time series data.

Teaching-Learning Process (General Instructions)

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

1. Chalk and TalkwithBlackBoard
2. ICT based Teaching
3. Demonstration-based Teaching

Module 1 **10 Hours**

Introduction, Five Important Practical Problems**, Autocorrelation Function and Spectrum of Stationary Processes:** Autocorrelation Properties of Stationary Models, Spectral Properties of Stationary Models, **Linear Stationary Models: General Linear Process, Autoregressive Processes, Moving Average Processes, Mixed Autoregressive--Moving Average Processes. Ch. 1.1, Ch. 2.1,2.2 Ch. 3.1,3.2,3.3,3.4**

Module 2 **10 Hours**

Linear Nonstationary Models: Autoregressive Integrated Moving Average Processes, Three Explicit Forms for the ARIMA Model, Integrated Moving Average Processes.

Forecasting : Minimum Mean Square Error Forecasts and Their Properties, Calculating Forecasts and Probability Limits, Examples of Forecast Functions and Their Updating, Use of State-Space Model Formulation for Exact Forecasting

Ch. 4.1,4.2,4.3, Ch. 5.1,5.2,5.3,5.4,5.5.

Module 3 **10 Hours**

Model Identification: Objectives of Identification, Identification Techniques, Initial Estimates for the Parameters, Model Multiplicity.

Parameter Estimation: Study of the Likelihood and Sum-of-Squares Functions, Nonlinear Estimation, Some Estimation Results for Specific Models, Likelihood Function Based on the State-Space Model, Estimation Using Bayes' Theorem

Ch. 6.1,6.2,6.3,6.4 Ch. 7.1,7.2,7.3,7.4,7.5.

Module 4	10 Hours
Model Diagnostic Checking: Checking the Stochastic Model, Overfitting, Diagnostic Checks Applied to Residuals, Use of Residuals to Modify the Model, **Analysis of Seasonal Time Series:** Parsimonious Models for Seasonal Time Series, Some Aspects of More General Seasonal ARIMA Models, Structural Component Models and Deterministic Seasonal Components, Regression Models with Time Series Error Terms. **Ch. 8.1,8.2,8.3 Ch. 9.1,9.2,9.3,9.4,9.5**	
Module 5	**10 Hours**
Multivariate Time Series Analysis: Stationary Multivariate Time Series, Vector Autoregressive Models, Vector Moving Average Models, Vector Autoregressive--Moving Average Models, Forecasting for Vector Autoregressive--Moving Average Processes, StateSpace Form of the VARMA Model, Nonstationary and Cointegration **Ch. 14.1,14.2,14.3,14.4,14.5,14.6,14.8**	

Course Outcomes (Course Skill Set):

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

CO1: Apply the fundamental concept of Time series analysis for Autocorrelation Function and spectrum on linear stationary models.

CO2: Develop non-linear stationary models and perform forecasting.

CO3: Identify models and estimate the various parameters .

CO4: Recognize ways to perform model diagnostic checking and analyze the seasonal time series .

CO5: Analyze multivariate time series data.

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.

Web links and Video Lectures(e-Resources):

- https://nptel.ac.in/courses/103106123
- https://www.youtube.com/watch?v=GE3JOFwTWVM
- https://www.youtube.com/watch?v=tepxdcepTbY
- https://www.youtube.com/watch?v=tepxdcepTbY

Suggested Learning Resources:

Text Books:

1. George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung, "Time Series Analysis – Forecasting and Control", Wiley Publications , 2016.

Reference Books:

1. Paul S.P. Cowpertwait and Andrew V. Metcalfe, Introductory Time Series with R, Springer Verlag, New York, 2009.
2. Rob J. Hyndman and George Athanasopoulos, Forecasting: Principles and Practice, One line, Open Access Textbooks.

Research Methodology and 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	30	**Exam Hours**	3
Examination type (SEE)	Theory		

Course Objectives:

- To Understand the knowledge on basics of research and its types.
- To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
- To Discuss the concepts of Intellectual Property Rights in engineering.

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 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	**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.

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.

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.

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 of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd

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

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.
CO2: To know the procedure of the literature Review and Technical Reading
CO3: To understand the fundamentals of the patent laws and drafting procedure
CO4: Understanding the copyright laws and subject matters of copyrights and designs
CO5: Understanding the basic principles of design rights

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)**

1. First test at the end of 5th week of the semester

2. Second test at the end of the 10th week of the semester

3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester

5. 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)**

6. 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**)

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored

shall be proportionally reduced to 50 marks

2. There will be 2 questions from each module. Each of the two questions under a module (with amaximum 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. Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.

References:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4
2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-3

INTRODUCTION TO DATA STRUCTURES			
Course Code	24AD66A	**CIE Marks**	50
Teaching Hours/Week(L:T:P)	3:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	03
Examination type(SEE)	Theory		

Course Objectives:

- Introduce primitive and non-primitive data structures
- Understand the various types of data structure along their operations
- Study various searching and sorting algorithms
- Assess appropriate data structures during program development / problem solving

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) does not mean only the traditional lecture method, but different types of teaching methods may be adopted to achieve the outcomes.
2. Utilize video / animation films to illustrate the functioning of various concepts.
3. Promote collaborative learning (Group Learning) in the class.
4. Pose at least three HOT (Higher Order Thinking) questions in the class to stimulate critical thinking.
5. Incorporate Problem-Based Learning (PBL) to foster students' analytical skills and develop their ability to evaluate, generalize, and analyze information rather than merely recalling it.
6. Introduce topics through multiple representations.
7. Demonstrate various ways to solve the same problem and encourage students to devise their own creative solutions.
8. Discuss the real-world applications of every concept to enhance students' comprehension.
9. Use any of these methods: Chalk and board, Active Learning, Case Studies.

Module-1 **8 Hours**

INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations pointers and dynamic Memory Allocation

ARRAYS and STRUCTURES: Arrays, Dynamic Allocated Arrays, Structures and Unions, Representation of Multidimensional Arrays, Strings.

Text book 1: Ch.8.1 to8.5, Ch.12.1 to12.8, 12.10, 12.11.
Text book 2: Ch.2.1to2.3, 2.5, 2.9.

Module-2 **8 Hours**

Stacks and Queues: Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions.

Text book 2: Ch.6.1to6.3, Ch.8.1 to 8.2.

Module-3	**8 Hours**
Linked Lists: Introduction, Singly Linked List, Operations on Singly Linked Lists, Implementation of Stacks and Queues using Linked List, Static Allocation Vs Linked Allocation, Additional List operations, Doubly Linked Lists, Circular Singly Linked List**.** **Text book 2:** Ch. 9.1to9.2, 9.3(Only 9.3.1to9.3.5, 9.3.11to9.3.12), 9.4to 9.5.	
Module-4	**8 Hours**
Trees: Introduction to Trees, Binary Trees, Tree Traversals, Binary Search Trees, Expression Trees. **Graphs:** Introduction, Elementary Graph Operations (BFS/DFS), Dijkstra's Algorithm. **Text book 2:** Ch.10.1to10.4,10.5(Only10.5.1,10.5.2,10.5.3.1,10.5.3.2,10.5.3.4),10.6.3.	
Module-5	**8 Hours**
Sorting: Introduction, Bubble Sort, Selection Sort, Insertion Sort. **Searching:** Introduction, Linear Search, Binary Search, Applications and Complexity Analysis **Text book 1:** Ch.17.1, 17.2.6, 17.3.2. **Text book 2:** Ch.11.1to11.3, 11.10.1.	

Course outcome (Course Skill Set)

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

1. Develop C programs utilizing fundamental concepts such as arrays, pointers and structures.
2. Apply data structures like stacks and queues to solve problems.
3. Develop C programs using linked lists and their various types.
4. Explain the fundamental concepts of trees, graphs and their practical applications.
5. Demonstrate different sorting and searching algorithms and determine their algorithmic complexities.

Assessment Details (both CIE and SEE)

The weight age 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 22 OB 2.4, 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. E. Balagurusamy, *C Programming and Data Structures*, 4th Edition, McGraw-Hill, 2007.
2. A. M. Padma Reddy, *Systematic Approach to Data Structures using C*, 9th Revised Edition, Sri Nandi Publications, 2009.

Reference Books:

1. Ellis Horowitz and Sartaj Sahni, *Fundamentals of Data Structures in C*, 2nd Edition, Universities Press, 2014.
2. Seymour Lipschutz, *Data Structures Schaum's Outlines*, Revised 1st Edition, McGraw-Hill, 2014.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=DFpWCl_49i0
- https://www.youtube.com/watch?v=x7t_-ULoAZM
- https://www.youtube.com/watch?v=I37kGX-nZEI
- https://www.youtube.com/watch?v=XuCbpw6Bj1U
- https://www.youtube.com/watch?v=R9PTBwOzceo
- https://www.youtube.com/watch?v=qH6yxkw0u78
- https://archive.nptel.ac.in/courses/106/105/106105085/
- https://onlinecourses.swayam2.ac.in/cec19_cs04/preview

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

Develop C programs that focus on Data Structure concepts such as arrays, pointers, structures, stacks, queues, linked lists, trees as well as sorting and searching algorithms (25 Marks).

Fundamentals of Operating Systems			
Course Code	24AD66B	**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		

Prerequisites:

The students should have knowledge on

- Programming skills
- Basic Computer Science Concepts
- Computer Organisation and Architecture

Course Objectives:

- To demonstrate the need and different types of OS
- To discuss suitable techniques for management of different resources
- To analyse different memory, storage, and file system management strategies.

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: What operating systems do; Computer System organization; Computer System Organization, Computer System architecture; Operating System operations; Resource Management

Operating System Structures: Operating System Servies, User and Operating System interface; System calls, Application Program Interface, Types of system calls

Textbook 1: Chapter 1: 1.1, 1.2, 1.3,1.4, 1.5 Chapter 2: 2.1, 2.2 (2.2.1, 2.2.2), 2.3 (2.3.2, 2.3.3)

Module 2 **8 Hours**

Process Management: Process concept; Process scheduling; Operations on processes; Inter-process Communication

Multi-threaded Programming: Overview; Multithreading models, Thread Libraries

Textbook 1: Chapter 3: 3.1-3.4, Chapter 4: 4.1, 4.3 5, 4.4

Module 3 **8 Hours**

CPU Scheduling: Basic Concepts, Scheduling criteria, Scheduling algorithms, Thread Scheduling

Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Semaphores; Classical problems of synchronization

Textbook 1: Chapter 5: 5.1, 5.2,5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.4 Chapter 6: 6.1, 6.2.,6.3, 6.6

Module 4 **8 Hours**

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock

Memory Management: Background; Contiguous memory allocation; Paging; Structure of page table, Swapping

Textbook 1: Chapter 8: 8.1-8.8 Textbook 1: Chapter 9: 9.1-9.4 (9.4.1, 9.4.2) Ch. 8.1,8.2,8.3 Ch. 9.1,9.2,9.3,9.4,9.5,9.6

Module 5 **8 Hours**

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement **File System Interface:** File concept; Access methods; Directory Structure, Protection, File System Implementation: File System Structure, File System Operations

File System Internals: File Systems, File System Mounting; Partition and Mounting, File sharing

Textbook 1: Chapter 10: 10.1-10.3, 10.4 (10.4.1, 10.4.2, 10.4.4.) Chapter 13: 13.1, 13.2, 13.3 (13.3.1, 13.3.2, 13.3.3), 13.4 (13.4.1, 13.4.2) Chapter 15: 15.1-15.4

Course Outcomes (Course Skill Set):

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

CO1: Explain the fundamentals of operating systems.

CO2: Apply appropriate CPU scheduling algorithm for the given scenarios.

CO3: Analyse the various techniques for process synchronization and deadlock handling.

CO4: Apply the various techniques for memory management

CO5: Analyse the importance of File System Mounting and File Sharing

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.

Web links and Video Lectures(e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105214/
- https://archive.nptel.ac.in/courses/106/102/1061021

Suggested Learning Resources:

Text Books:

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 10th edition, Wiley-India, 2015

Reference Books:

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition, 2010
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGrawHill, 2013, P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
3. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008

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

- Students are expected to prepare animated PPT to illustrate the different types of Process Scheduling and Paging. (10 Marks)
- Students are required to prepare detailed case study report on Deadlocks OR Students can illustrate deadlock using any programming language (15 Marks)

MOBILE APPLICATION DEVELOPMENT			
Course Code	24AD66C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40 Theory	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The Students Should have knowledge of Java Programming

Course objectives:

Create, test and debug Android application by setting up Android development environment. Implement adaptive, responsive user interfaces that work across a wide range of devices.
Infer long running tasks and background work in Android applications
Demonstrate methods in storing, sharing and retrieving data in Android applications
Analyze performance of android applications
Describe the steps involved in publishing Android application to share with the world.

Teaching-Learning Process (General Instructions)

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 to Android OS: Android Description – Open Handset Alliance – Android. Ecosystem – Android versions – Android Activity – Features of Android – Android Architecture Stack Linux Kernel. Configuration of Android Environment: Operating System – Java JDK Android SDK – Android Development Tools (ADT) – Android Virtual Devices (AVDs) – Emulators Dalvik Virtual Machine – Differences between JVM and DVM – Steps to Install and Configure Eclipse and SDK.
(Chapters 1 & 2)

Module-2 **8 Hours**

Create the first android application: Directory Structure. Android User Interface: Understanding the Components of a screen– Linear Layout – Absolute Layout – Frame. Layout Relative Layout – Table Layout.
(Chapters 3 & 4)

Module-3 **8 Hours**

Designing User Interface with View – Text View – Button – Image Button – Edit Text Check Box – Toggle Button – Radio Button and Radio Group – Progress Bar – Auto complete Text View – Spinner – List View – Grid View – Image View - Scroll View – Custom Toast – Alert – Time and Date Picker.
(Chapter 5)

Module-4 **8 Hours**

Activity: Introduction – Intent – Intent filter – Activity life cycle – Broadcast life cycle Service.
Multimedia: Android System Architecture – Play Audio and Video – Text to Speech.
(Chapters 6 & 7)

Module-5 **8 Hours**

SQLite Database in Android: SQLite Database – Creation and Connection of the database – Transactions.
Case Study: SMS Telephony and Location Based Services.
(Chapters 8, 9, & 10)

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

1. Explain Mobile Application Ecosystem like concepts, architecture, and lifecycle of mobile applications on Android
2. Identify the key components of mobile application frameworks and development tools.
3. Apply design principles to create intuitive and responsive user interfaces using appropriate UI/UX tools.
4. Develop Functional Mobile Applications -Integrate core functionalities such as layouts, event handling, navigation, and multimedia support into applications.
5. Implement local data storage mechanisms (SQLite, Shared Preferences) and external databases (Firebase, APIs) for mobile applications.

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.
   - Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1. Books 1. TEXT BOOK 1. Prasanna Kumar Dixit, "Android", Vikas Publishing House Private Ltd., Noida, 2014. 2. REFERENCE BOOKS 1. Reto Meier and Wrox Wiley, "Professional Android 4 Application Development", 2012.
2. 2. ZiguradMednieks, LaridDornin, G.BlakeMeike, Masumi Nakamura, "Programming Andriod", O'Reilly,2013. 3. Robert Green, Mario Zechner, "Beginning Android 4 Games Development", Apress Media LLC, New York, 2011

Web links and Video Lectures(e-Resources):

- .https://www.geeksforgeeks.org/android-tutorial/
- https://developer.android.com/
- https://www.tutorialspoint.com/android
- https://www.w3schools.blog/android-tutorial

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

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

INTRODUCTION TO ARTIFICIAL INTELLIGENCE			
Course Code	24AD66D	**CIE Marks**	50
Teaching Hours/Week (L:T:P)	3:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	3
Examination nature (SEE)	Theory/		

Course objectives:

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

Teaching-Learning Process (General Instructions)

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

1. Lecturer methods (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 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. Demonstrate ways to solve the same problem and encourage the students to come up with their own creative solutions.
8. Discuss application of every concept to solve the real world problems.

MODULE-1 **8 Hours**

Introduction: What is AI? Foundations and History of AI **Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents**.**

Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4

MODULE-2 **8 Hours**

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4

MODULE-3	8 Hours
Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions **Logical Agents**: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic **Text book 1**: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5	
MODULE-4	**8 Hours**
First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic** :Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining. Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5	
MODULE-5	**8 Hours**
Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. **Expert Systems:** Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 Text Book 2: Chapter 20	

Course outcomes (Course Skill Set):

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

CO1: Apply knowledge of agent architecture, searching and reasoning techniques for different applications.

CO 2. Compare various Searching and Inferencing Techniques.

CO 3. Develop knowledge base sentences using propositional logic and first order logic

CO 4. Describe the concepts of quantifying uncertainty.

CO5: Use the concepts of Expert Systems to build applications.

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 (maximum marks 50)

- CIE marks for the theory component are **50 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 . (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component .

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 scoredby the student shall be proportionally scaled down to 50 Marks

Suggested Learning Resources:

Text Books

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

Reference:

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

Web links and Video Lectures (e-Resources)

1. **https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html**
2. **https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409**
3. **https://nptel.ac.in/courses/106/105/106105077/**

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

1. Group discussion on Real world examples
2. Project based learning
3. Simple strategies on gaming, reasoning and uncertainty etc

Mini Project			
Course Code	24ADP67	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:4	**SEE Marks**	-
Credits	02	**Total Marks**	100
Contact Hours	-	**Exam Hours**	-
Examination type (SEE)	-		

Prerequisites:

Nil

Course Contents

Guidelines:

In order to address challenges within the realm of cutting-edge technologies, students are required to collaborate in groups of three or four. Each group focuses on solving a problem within a specific domain. To provide guidance and oversight of project advancement, an Internal Guide is assigned to each batch. These guides possess expertise in the relevant domain. Should the need arise, the Internal Guide is capable of organizing clarification sessions to address any uncertainties raised by the students working on the project. These interactions are duly documented for future reference.

Relevance of Project:

Students are expected to articulate the significance of their project within the current IT landscape and broader society.

Literature Survey:

Students must conduct a thorough review of research articles and existing projects to pinpoint gaps within the identified problem statement.

Design:

Students are required to formulate a comprehensive design document encompassing class, use case, component diagrams, state models, sequence models, activity diagrams, and interaction models.

Implementation:

Students should execute the designed model using appropriate techniques.

Presentation:

Regularly, students are to present their progress to the evaluation committee. The committee evaluates based on the quality of the presentation, depth of content coverage, adeptness in addressing raised questions, and the evident division of teamwork. Scores are determined within this criterion for individual students.

Report:

Each group must compose a project report and submit it to the department. Reports are expected to adhere to the standardized format set by the department.

Course outcomes (Course Skill Set):

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

CO1: Conduct a systematic literature review to synthesize current knowledge, identify gaps, and justify a focused problem statement in the chosen AIML area. (PO - 1,11, PSO - 1, 2)

CO2: Formulate specific objectives and select appropriate methods/tools (e.g., theoretical analysis, simulations, model development, hardware/edge deployment) aligned to the problem context. (PO – 8,9,10,11, PSO – 1,2)

CO3: Design and implement a working solution (code/simulation/prototype), following sound engineering practices, reproducible workflows, and version control. (PO – 1,2,3,4,5,6,7,8,9,10,11, PSO – 1,2)

CO4: Plan tasks and milestones; maintain a professional journal/progress reports that evidence work completed, decisions taken, and a schedule for remaining tasks within the allotted timeline. (PO – 1,2,3,4,5,6,7,8,9,10,11, PSO – 1,2)

CO5: Deliver a structured technical presentation demonstrating individual contributions, and produce a formal report that clearly documents methodology, results, and conclusions. (PO – 1,2,4,8,9,10,11, PSO – 1,2)

Assessment Details (CIE):

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25.

YOGA			
Course Code	24YO68	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	0
Credits	0	**Total Marks**	100
Contact Hours	20-24	**Exam Hours**	
Examination type (SEE)	Practical		

Module-1 **3 Hours**

Ashtanga Yoga: Patanjali's Ashtanga Yoga its need and importance.

1. Dharanai
2. Dhyana (Meditation)
3. Samadhi

Module-2 **3 Hours**

Suryanamaskara: Revision of practice l2 count 8 rounds

Module-3 **3 Hours**

Asanas: Need, importance of Asana. Different types, Asana by narne, technique, precautionary measures and benefits of each asana.

Different types of Asanas

1. Sitting
    a. Bakasana
    b. Hanumanasana
    c. Ekapada Rajakapotasana
    d. Yogarnudra in Vajrasana
2. Standing
    a. Vatayanasana
    b. Garudasana
3. Balancing
    a. Veerabhadrasana
    b. Sheershasana

Module-4 **3 Hours**

Kapalabhati: Revision of Kapalabhati practice 80 strokes/min 3 rounds

Module-5 **3 Hours**

Pranayama: Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama.

Different types Pranayama

1. Bhastrika
2. Bhramari

NATIONAL SERVICE SCHEME (NSS)			
Course Code	24NS68	**CIE Marks**	100
Teaching Hours/Week (L: T:P)	0:0:2	**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: National Service Scheme (NSS) will enable the students to:

- Understand the community in general in which they work.
- Identify the needs and problems of the community and involve them in problem –solving.
- Develop among themselves a sense of social & civic responsibility & utilize their knowledge
- in finding practical solutions to individual and community problems.
- 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.

General Instructions - Pedagogy :

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

- 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.
- State the need for NSS activities and its present relevance in the society and Provide real-life examples.
- Support and guide the students for self-planned activities.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- 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/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
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 issues.
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. Foreg. 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	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.

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.

1. **Evaluation Of the Topic** Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2. **Activity Report:** Report should be submitted by individual to the concerned evaluation authority
3. **Team Size:** May be individual or team

Sl No	Topic	Location	Activity execution
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	Farmers land/Villages/ roadside/ community area/ College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
2.	Waste management– Public, Private and Govt organization, 5 R's.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/proper consultation/Continuous monitoring/ Information board
4.	Water conservation techniques – Role of different stakeholders– Implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	Villages/ City Areas / Gram panchayat/ public associations/Government Schemes officers/campus etc…..	Group selection/pro per consultation/Continuous monitoring/ Information board
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board

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.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board
10.	Plantation and adoption of plants. Know your plants.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
11.	Organize National integration and social harmony events /workshops/seminars. (Minimum 02 programs).	Villages/ City Areas Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II			
Course Code	24PE68	**CIE Marks**	**100 Marks**
Teaching Hours/Week (L: T: P)	0:0:2		
Examination type (SEE)	24P		

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

1. Understand the Postural deformities and Stress management in sports and athletics
2. Participate in the competition at regional/state / national / international levels.
3. Understand and practice of specific games and athletic Jumping events.
4. Understand and practice of Aerobics.

Module IV : Orientation **4 Hours**

1. Postural deformities.
2. Stress management

Module V : Specific Games (Any one to be selected by the student) **16 Hours**

1. Throw ball
2. Table Tennis
3. Athletics (Field Events- Jumps) – Any event as per availability of Ground**.**

Module VI: Aerobics **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

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**