V Semester

BE in Information Science & Engineering Scheme of Teaching V Semester Outcome Based Education and Choice Based Credit System (CBCS) Effective from the academic year Batch - 2024-28											
Sl. No	Course	Course Code	Course Title	Teaching Department (TD)/ Board	Teaching Hours /Week			Examination			
					Theory	Tutorial	Practical	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1	HSMC	24IS51	Software Quality and Project Management	ISE	3	0	0	50	50	100	3
2	PCC	24IS52	Theory of Computation	ISE	3	2	0	50	50	100	4
3	IPCC	24IS53	Computer Networks	ISE	3	0	2	50	50	100	4
4	PCCL	24ISL54	Data Analytics with Power BI and Tableau Lab	ISE	0	0	2	50	50	100	1
5	PEC	24IS55X	Program Elective Course-1	ISE	3	0	2	50	50	100	4
6	PEC	24IS56X	Program Elective Course-2	ISE	3	0	2	50	50	100	4
7	NCMC	24ES57	Environmental Studies and E-Waste Management*	CV	1	0	0	100	-	100	-
8	MC	24NS58/ 24PE58/ 24YO58	NSS/YOGA/ PE	NSS/ YOGA/ PE Coordinator	0	0	2	100	-	100	-
Total								**500**	**300**	**800**	**20**

Program Elective Course-1					
24IS55A	MongoDB	24IS55C	Computer Vision	24IS55E	Data Warehousing And Data Mining
24IS55B	Fundamentals of Data Science	24IS55D	Cryptography Network Security And Cyber Laws		

Program Elective Course-2			
24IS56A	Business Intelligence	24IS56C	Natural Language Processing
24IS56B	Data Analytics with R	24IS56D	Quantum Algorithms and Cryptography

SOFTWARE QUALITY & PROJECT MANAGEMENT			
Course Code	24IS51	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	3	**Total Marks**	100
Contact Hours		**Exam Hours**	3
Examination type (SEE)	Theory /Practical		

Prerequisite:
Basic knowledge of programming, data structures, DBMS, operating systems, and computer networks.

Course objectives:

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

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

MODULE-1 **8 Hours**

Software Engineering: The nature of Software, The unique nature of 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 scenarios. (PO – 1,2,3 PSO –1,2,3)

CO2: Analyze the various AGILE Process Models. (PO – 1,2,3 PSO –1,2,3)

CO3: Illustrate the role of project planning and project evaluation. . (PO – 1,2,3,10 PSO –1,2,3)

CO4: Understand the importance of software estimation and risk management. . (PO – 1,2,3 PSO –1,2,3)

CO5: Identify appropriate techniques to enhance software quality. . (PO – 1,2,3 PSO –1,2,3)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation(CIE):

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

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

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

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

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

Semester-End Examination: 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. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.

References:

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

Web links and Video Lectures (e-Resources):

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

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

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

Theory of Computation			
Course Code	24IS52	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:2:0	**SEE Marks**	50
Credits	04	**Total Marks**	100
Contact Hours	50	**Exam Hours**	03
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge of

- Discrete Mathematics

Course Objectives:

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

Teaching-Learning Process (General Instructions)

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

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

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

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

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

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

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation(CIE):

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● 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 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:

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/106104148
- 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	24IS53	**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)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

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

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

Module-2 **8 Hours**

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

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

Module-3 **8 Hours**

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

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

Module-4 **8 Hours**

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

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

Module-5 **8 Hours**

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

Textbook: Ch.25.1-25.2,26.1-26.6

PRACTICAL COMPONENT OF IPCC

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

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

Course outcomes (Course Skill Set):

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

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

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

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

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

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

Assessment Details (both CIE and SEE)

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

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

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

CIE for the practical component of the IPCC

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

SEE for IPCC

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

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

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

Suggested Learning Resources:

Textbook:

1. BehrouzA.Forouzan,Data Communications and Networking,5thEdition,TataMcGraw-Hill,2013.

Reference Books:

1. Larry L.Peterson and BruceS.Davie:ComputerNetworks–A Systems Approach,4th Edition, Elsevier, 2019.
2. NaderF.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/10610

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

- Role Play
- Flipped classroom
- Case Study
- Programming Assignment

Data Analytics with Power BI and Tableau Lab			
Course Code	24ISL54	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	0:0:2	**SEE Marks**	50
Credits	1	**Total Marks**	100
Contact Hours	28	**Exam Hours**	3
Examination type (SEE)	Practical		

Prerequisites:

The students should have knowledge on.

- Basic knowledge of Statistics
- Basic understanding of Databases
- Fundamentals of Spreadsheet Tools

Course Objectives:

- Introduce students to Business Intelligence (BI) tools such as Power BI and Tableau for data Visualization and analytics.
- Enable students to import, clean, transform, and manage real-world datasets.
- Develop skills to create interactive dashboards using charts, KPIs, filters, and calculated measures.
- Apply analytical techniques to interpret business, financial, healthcare, and operational datasets.
- Enhance students' ability to communicate insights effectively through visual storytelling.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Programs List:

1.	Create an interactive Sales Performance Dashboard using Power BI or Tableau to analyze total sales, total profit, regional sales distribution, and category-wise performance. Include KPI indicators and filters for year-wise analysis.

2.	Develop a dashboard to analyze student academic performance using subject-wise marks and attendance data. Identify top-performing students and analyze the relationship between attendance and marks
3.	Using a COVID-19 dataset, create visualizations to analyze confirmed cases, deaths, and vaccination trends. Include time-series analysis and geographical representation using map visualization.
4	Build a dashboard to analyze employee attrition data. Calculate attrition rate and visualize department-wise attrition, salary distribution, and job role impact on employee turnover.
5.	Create a dashboard to analyze bank loan approval data. Visualize loan approval status, income vs loan amount, and identify risk categories using appropriate charts.
6.	Using an e-commerce dataset, create a dashboard to identify top customers, analyze monthly sales trends, and evaluate product category performance.
7	Develop visualizations to analyze temperature and rainfall data over time. Create monthly trend charts and comparative visualizations for different cities.
8	Create a dashboard to analyze social media engagement metrics such as likes, shares, and comments. Calculate engagement rate and compare performance across platforms.
9	Using historical stock market data, create a dashboard to visualize closing price trends, trading volume, and moving average indicators.
10	Develop a dashboard to monitor supply chain efficiency by analyzing delivery time, supplier performance, and inventory turnover using appropriate KPIs and charts.

Course outcomes (Course Skill Set):

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

CO1: Import, clean and transform datasets using Power BI and Tableau.(PO-2,5,11 PSO- 1,2)
CO2: Create interactive dashboards using appropriate charts and KPIs. (PO-1,3,5 PSO-2)
CO3: Perform exploratory data analysis and derive insights from business datasets. (PO-1,2,4,5 PSO- 1)
CO4: Apply analytical techniques to solve real-world data problems. (PO-1,2,3 PSO-1,2)
CO5: Interpret visualizations and communicate analytical findings effectively. (PO- 5,8,9 PSO-1)

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

Semester-End Examination:

SEE 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 from PART-A and one question from PART-B (experiment) from the questions lot prepared by the examiners jointly and 50% weightage for each part.
- 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

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=5PrZvPeUw60
- **https://www.youtube.com/watch?v=V-s8c6jMRN0&list=PLO9LeSU_vHCWUvkE1FrGeNxSve7YtJrYl**

MONGODB			
Course Code	24IS55A	**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

- Basics of Database Management Systems
- SQL fundamentals
- Basic programming knowledge (Java/Python/Node.js preferred)

Course Objectives:

This course will enable students to,

- Understand the fundamentals of NoSQL databases and their importance.
- Learn MongoDB architecture and document-oriented data modeling.
- Perform CRUD operations using MongoDB.
- Design scalable database solutions using indexing and aggregation.
- Integrate MongoDB with applications.
- Apply MongoDB in real-time data-driven applications.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1	**8 Hours**

Introduction to NoSQL and MongoDB: Understand the fundamentals of NoSQL databases and their importance, Learn MongoDB architecture and document-oriented data modeling. Perform CRUD operations using MongoDB. Design scalable database solutions using indexing and aggregation. Integrate MongoDB with applications. Apply MongoDB in real-time data-driven applications.

Textbook 1: Chapter 1 (pp. 1–18), Chapter 2 (pp. 19–36), Textbook 2: Chapter 1 (pp. 1–28)

Module-2	**8 Hours**

Data Modeling in MongoDB: BSON Data Format, Documents and Collections, Data Types in MongoDB, Schema Design Principles, Embedded vs Referenced Documents, Relationships in MongoDB, Schema Validation.

Textbook 1: Chapter 3 (pp. 37–68) Textbook 2: Chapter 2 (pp. 29–60)

Module-3	**8 Hours**

CRUD Operations: Creating Database and Collections, Insert Operations, Read Operations and Query Operators Update Operations, Delete Operations, Bulk Operations.

Textbook 1: Chapter 4 (pp. 69–110) Textbook 2: Chapter 3 (pp. 61–100)

Module-4	**8 Hours**

Advanced MongoDB Concepts: Indexing Techniques, Performance Optimization, Aggregation Framework MapReduce (Introduction), Transactions in MongoDB.

Textbook 1: Chapter 5 (pp. 111–150), Textbook 2: Chapter 6 (pp. 160–210)

Module-5 **8 Hours**

Replication, Sharding & Security: Replica Sets, Data Replication, Sharding Concepts, Backup and Restore Authentication and Authorization, Role-Based Access Control, Data Encryption.

Textbook 1: Chapter 6 (pp. 151–190), Textbook 2: Chapter 7 (pp. 211–250)

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1.	Install MongoDB Community Edition and create a database. Implement basic MongoDB shell commands to create collections and insert documents.
2.	Create a Student collection and implement insert operations using insertOne() and insertMany() with embedded documents and arrays.
3.	Implement various query operations using find() with comparison operators ($gt, $lt, $eq) and logical operators ($and, $or). Apply projection and sorting..
4.	Develop a program to perform update operations using updateOne() and updateMany() with operators such as $set, $inc, $push, and $pull.
5.	Implement delete operations using deleteOne() and deleteMany(). Demonstrate dropping collections and databases. a program to implement a sliding window protocol in the data linklayer.
6.	Create single field, compound, and text indexes. Compare query performance using explain() with and without indexing.
7.	Develop aggregation queries using $match, $group, $project, $sort, and $lookup to generate summary reports (e.g., total sales per category).
8.	Design and implement embedded and referenced document models for a Library or E-commerce database. Compare both approaches.
9	Using MongoDB with Python (PyMongo) or Node.js, develop a client application to perform full CRUD operations on a database.
10.	Develop a mini project using MongoDB (e.g., Inventory Management / Hospital Management / Student Result Analysis System) implementing schema design, CRUD operations, indexing, and aggregation.

Note: For the MongoDB laboratory experiments, students must design and modify document schemas, perform CRUD and aggregation operations with different datasets, and analyze the results obtained. Performance comparison using indexing and explain() should be carried out wherever applicable. Installation of MongoDB Server and MongoDB Compass/Atlas must be demonstrated and documented. All experiments should include schema design, MongoDB queries, output screenshots, observations, and conclusions. Application-based programs may be implemented using Python/Node.js with MongoDB connectivity.

Course outcomes (Course Skill Set):

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

CO1: Explain NoSQL concepts and compare them with relational databases. (PO – 1,2,4 PSO – 1,2)

CO2: Design schema using document-based data modeling. (PO –1,2,3 PSO – 2)

CO3: Perform CRUD operations using MongoDB commands. (PO – 1,2,5 PSO –1,3)

CO4: Apply indexing and aggregation for performance optimization. (PO – 1,2,3,4 PSO –1,2)

CO5: Develop applications integrated with MongoDB. (PO – 1,2,3,6 PSO –1,2,3)

CO6: Implement MongoDB in real-world use cases. (PO –1,2,3,4,6 PSO –1,2,3)

Assessment Details (both CIE and SEE):

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

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

- 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.
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:

1. Kristina Chodorow – *MongoDB: The Definitive Guide*, 3rd Edition, O'Reilly, 2019.
2. Shannon Bradshaw, Kristina Chodorow – *MongoDB in Action*, 2nd Edition, Manning, 2016.

Reference Books:

1. Kristina Chodorow, MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2019.
2. Shannon Bradshaw, Kristina Chodorow, MongoDB in Action, 2nd Edition, Manning Publications, 2016.
3. Cyrus Dasadia, Practical MongoDB: Architecting, Developing, and Administering MongoDB, Packt Publishing, 2019.

Web links and Video Lectures(e-Resources):

- *MongoDB Basics* – Free self-paced course by MongoDB University https://university.mongodb.com/courses/M001/about
- *MongoDB for Developers* – Free course with hands-on labs https://university.mongodb.com/
- https://nptel.ac.in/courses/106104135

(These provide certificates too after completion.)

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

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

Fundamentals of Data Science			
Course Code	24IS55B	**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:

Basic Programming Knowledge

Familiarity with programming concepts such as variables, loops, functions, and data structures (preferably in Python).

Mathematics Fundamentals

Understanding of basic algebra, matrices, vectors, and elementary calculus (derivatives).

Basic Statistics Knowledge

Concepts such as mean, median, variance, probability, and basic statistical reasoning.

Logical and Analytical Thinking

Ability to interpret problems, analyze data patterns, and apply problem-solving techniques.

Basic Computer Skills

Familiarity with using software tools, reading files, and handling basic data formats (CSV, text files)

Course Objectives:

- Understand the fundamental concepts of Data Science, including data visualization, linear algebra, probability, and statistical analysis required for data-driven decision making.
- Apply statistical inference techniques such as hypothesis testing, confidence intervals, Bayesian inference, and gradient descent to analyze and interpret real-world datasets.
- Develop and evaluate machine learning models including k-Nearest Neighbors, Naive Bayes, Linear Regression, Logistic Regression, Support Vector Machines, and assess model performance.
- Design and implement advanced learning algorithms such as Decision Trees, Random Forests, Neural Networks, and Clustering techniques for solving complex predictive problems.
- Apply data science techniques to specialized domains including Natural Language Processing, Network Analysis, and Recommender Systems to extract insights from structured and unstructured data.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction : What is Data Science?

Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra,** Vectors, Matrices, **Statistics,** Describing a Single Set of Data, Correlation, Simpson‟s Paradox, Some Other Correlational Caveats, Correlation and Causation, **Probability,** Dependence and Independence, Conditional Probability, Bayes‟s Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

Textbooks 1: Chapters **1, 3, 4, 5, 6, Textbooks 2:**Chapters **1, 2**

Module-2 **8 Hours**

Hypothesis and Inference,Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, **Gradient Descent,** The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, **Getting Data,** stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, **Working with Data,** Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction.

Textbooks 1:Chapters **7, 8, 9, 10, Textbooks 2:**Chapters **3, 4**

Module-3 **8 Hours**

Machine Learning, Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, **k-Nearest Neighbors,** The Model, Example: The Iris Dataset, The Curse of Dimensionality, **Naive Bayes,** A Really Dumb Spam Filter, A More sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, **Simple Linear Regression,** The Model, Using Gradient Descent, Maximum Likelihood Estimation, **Multiple Regression,** The Model, Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, **Logistic Regression,** The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

Textbooks 1:Chapters **11, 12, 13, 14, 15, 16 Textbooks 2:**Chapters **3, 4, 5, 6**

Module-4 **8 Hours**

Decision Trees, What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, **Neural Networks,**Perceptrons, Feed Forward Neural Networks, Backpropagation, Example: Fizz Buzz, **Deep Learning,** The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: FizzBuzz Revisited, Softmaxes and Cross-Entropy, Dropout, Example: MNIST, Saving and Loading Models, **Clustering,** The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering.

Textbooks 1:Chapters **17, 18, 19, 20, Textbooks 2:**Chapters **6, 10, 11**

Module-5 **8 Hours**

Natural Language Processing, Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, **Network Analysis,** Betweenness Centrality, Eigenvector Centrality,Directed Graphs and PageRank, **Recommender Systems,**Manual Curation, Recommending What‟s Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization.

Textbooks 1:Chapters **21, 22, 23, Textbooks 2:**Chapters **13, 14, 15**

PRACTICAL COMPONENT OF IPCC

Sl. No	Experiments
1	A study was conducted to understand the effect of number of hours the students spent studying on their performance in the final exams. Write a code to plot line chart with number of hours spent studying on x-axis and score in final exam on y-axis. Use a red „*‟ as the point character, label the axes and give the plot a title.
2	For the given dataset mtcars.csv (www.kaggle.com/ruiromanini/mtcars), plot a histogram to check the frequency distribution of the variable „mpg‟ (Miles per gallon)
3	Consider the books dataset BL-Flickr-Images-Book.csv from Kaggle

	(https://www.kaggle.com/adeyoyintemidayo/publication-of-books) which contains information about books. Write a program to demonstrate the following. 1. Import the data into a DataFrame 2. Find and drop the columns which are irrelevant for the book information. 3. Change the Index of the DataFrame 4. Tidy up fields in the data such as date of publication with the help of simple regular expression. Combine str methods with NumPy to clean columns
4	Train a regularized logistic regression classifier on the iris dataset (https://archive.ics.uci.edu/ml/machine-learning-databases/iris/ or the inbuilt iris dataset) using sklearn.Train the model with the following hyperparameter C = 1e4 and report the best classification accuracy.
5	Train an SVM classifier on the iris dataset using sklearn. Try different kernels and the associated hyperparameters. Train model with the following set of hyperparameters RBF-kernel, gamma=0.5, one vs-rest classifier, no-feature-normalization. Also try C=0.01,1,10C=0.01,1,10. For the above set of hyperparameters, find the best classification accuracy along with total number of support vectors on the test data
6	Consider the following dataset. Write a program to demonstrate the working of the decision tree based ID3 algorithm
7	Consider the dataset spiral.txt (https://bit.ly/2Lm75Ly). The first two columns in the dataset corresponds to the co-ordinates of each data point. The third column corresponds to the actual cluster label. Compute the rand index for the following methods: 1. K – means Clustering 2. Single – link Hierarchical Clustering 3. Complete link hierarchical clustering. Also visualize the dataset and which algorithm will be able to recover the true clusters.
8	Implement a k-Nearest Neighbor algorithm to classify the iris dataset. Print out both correct and wrong predictions.

Course outcomes (Course Skill Set):

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

CO1: Explain and apply fundamental concepts of data science, including data visualization, linear algebra, probability, and descriptive statistics to analyze datasets. (PO-1,2 PSO-1,2,3)

CO2: Perform statistical inference using hypothesis testing, confidence intervals, Bayesian methods, and interpret results for data-driven decision making. (PO-1,2,4 PSO-1,2,3)

CO3: Build and evaluate supervised machine learning models such as k-Nearest Neighbors, Naive Bayes, Linear Regression, Logistic Regression, and Support Vector Machines. (PO-1,2,3,,5 PSO-1,2,3)

CO4: Design and implement advanced models including Decision Trees, Random Forests, Neural Networks, and clustering techniques for solving real-world problems. (PO-,2,3,4,5 PSO-1,2,3)

CO5: Apply data science techniques in practical domains such as Natural Language Processing, Network Analysis, and Recommender Systems to extract meaningful insights from data. (PO-1,2,3,5,6,7,8,9 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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

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

- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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:

Textbooks:

1.Data Science from Scratch: First Principles with Python – Joel Grus, O'Reilly Media.

2.Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems – Aurélien Géron, O'Reilly Media.

References:

1.Python Data Science Handbook: Essential Tools for Working with Data – Jake VanderPlas, O'Reilly Media.

2. An Introduction to Statistical Learning: with Applications in R – Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, Springer.

Web links and Video Lectures(e-Resources):

1. Python Data Science Handbook (Online / Free)
https://jakevdp.github.io/PythonDataScienceHandbook/ — Full content of *Python Data Science Handbook* available as Jupyter notebooks online.

2. Data Science from Scratch (PDF)
https://jcer.in/jcer-docs/E-Learning/Digital%20Library%20/E-Books/Data%20Science%20from%20Scratch%20by%20Joel%20Grus.pdf — PDF version of *Data Science from Scratch*.

3. An Introduction to Statistical Learning (Free PDF)
https://www.stat.berkeley.edu/~rabbee/s154/ISLR_First_Printing.pdf — Free PDF of *An Introduction to Statistical Learning*.

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

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

Computer Vision			
Course Code	24IS55C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	03	**Total Marks**	100
Contact Hours	40 Theory + 20 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- mathematics (linear algebra and probability)
- digital image processing
- basic programming skills
- fundamental algorithmic knowledge

Course Objectives:

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

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analysing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language

Module-1 **8 Hours**

Introduction: What is computer vision? A brief history. Image Formation: Photometric image formation, the digital camera. Image Processing: Point operators, linear filtering.

Text book: Chapter 1 (1.1, 1.2), Chapter 2 (2.2, 2.3), Chapter 3 (3.1, 3.2)

Module-2 **8 Hours**

Image Processing: More neighborhood operators, Fourier transforms, pyramids and wavelets, and geometric transformations.

Text book: Chapter 3 (3.3 – 3.6)

Module-3 **8 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 and region splitting & merging.

Text book 2: Chapter 5 (5.1 to 5.4), Chapter 10 (10.1 to 10.3.2, 10.4)

Module-4 **8 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.

Text book 2: Chapter 6 (6.1 to 6.8)

Module-5 **8 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 and chain codes only). Image Pattern Classification Background, patterns and classes, pattern classification by prototype matching (minimum distance classifier only).

Text book 2: Chapter 9 (9.1 to 9.5), Chapter 11 (11.1 to 11.2.2), Chapter 12 (12.1 to 12.3.1)

PRACTICAL COMPONENT OF IPCC

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 outcomes (Course Skill Set):

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

CO1: Explain the fundamentals of computer vision and its applications. (PO – 1,2,3, PSO –1,2,3)

CO2: Apply the image enhancement techniques for smoothing and sharpening of images. (PO –1,2,3,4,5 PSO –1,2,3)

CO3: Compare the different image restoration and segmentation techniques. (PO –1,2,3,4,5 PSO –1,2,3)

CO4: Demonstrate the smoothing and sharpening techniques for color images. (PO –1,2,3,4,5 PSO –1,2,3)

CO5: Explain morphological, feature extraction, and pattern classification techniques for object recognition. (PO –1,2,3,4,5 PSO –1,2,3)

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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. *Richard Szeliski*, Computer Vision: Algorithms and Applications *(Texts in Computer Science)*, ***2nd Edition****, Springer, 2022.*
2. *Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins*, Digital Image Processing, ***4th Edition****, Pearson, 2019.*

Reference Books

1. David Forsyth and Jean Ponce, *Computer Vision: A Modern Approach*, **2nd Edition**, Pearson, 2015.
2. Reinhard Klette, *Concise Computer Vision: An Introduction into Theory and Algorithms*, Springer, 2014.

Web links and Video Lectures(e-Resources):

- Virtual Labs: https://cse19.iith.vlabs.ac.in/
- NPTEL Online Courses: https://onlinecourses.nptel.ac.in/noc21_ce78/preview
- **Introduction to Machine Vision:** https://www.youtube.com/watch?v=tj2gcZ0bpfU
- **Computer Vision Tutorial (Lehigh University):** 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 using C++ / Java / Python – 10 Marks

Programming Assignment – 2: Implementation of segmentation, morphological, and color image processing techniques using C++ / Java / Python – 15 Marks

Cryptography, Network Security And Cyber Laws			
Course Code	24IS55D	**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 on;

- Basic knowledge of Computer Networks (OSI and TCP/IP models).
- Fundamentals of Java programming and object-oriented concepts.
- Understanding of Discrete Mathematics (sets, functions, modular arithmetic).
- Basic concepts of Data Structures and Algorithms.
- Introductory knowledge of Operating Systems and system security concepts.

Course Objectives:

CLO1: To introduce cyber security fundamentals, classical cryptography techniques, and the mathematical foundations required for modern cryptographic systems.

CLO2: To understand public key cryptography, RSA algorithm, cryptographic hash functions, and key exchange mechanisms for secure communication.

CLO3: To explain key management, authentication protocols, and network layer security mechanisms including IPSec, VPNs, and SSL/TLS.

CLO4: To analyze wireless, malware, firewall, intrusion detection, DDoS, and web service security mechanisms.

CLO5: To understand cyber laws and the legal framework of the IT Act governing electronic records, digital signatures, and cyber offences

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction - Cyber Attacks, Defence Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction.

Text book 1: 1,2,3

Module-2 **8 Hours**

Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications

Text book 1:4,5,6

Module-3 **8 Hours**

Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity–based Encryption, Authentication–I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centalised Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPSec Security at the Network Layer – Security at Different layers: Pros and Cons, IPSec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, OpenSSL

Text book 1:7,8,9

Module-4 **8 Hours**

IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WS-Security, SAML, Other Standards.

Text book 1: 10,11,12

Module-5 **8 Hours**

IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions

Text book 2: 19,20

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1.	Write a Java program to encrypt and decrypt a message using the Caesar cipher technique.
2.	Write a Java program to perform encryption and decryption using a transposition cipher.
3.	Write a Java program to encrypt and decrypt data using the DES algorithm.
4.	Write a Java program to implement public key cryptography using the RSA algorithm.
5.	Write a Java program to simulate secure key exchange using the Diffie–Hellman algorithm.
6.	Write a Java program to generate a message digest using the SHA-256 hash function.
7.	Write a Java program to create and verify a digital signature using RSA.
8.	Write a Java program to simulate a challenge–response based authentication mechanism.
9	Write a Java program to implement secure client–server communication using SSL/TLS.
10.	Write a Java program to demonstrate secure message transmission using encryption and hashing.

Course outcomes (Course Skill Set):

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

CO1: Explain fundamental concepts of cyber security, cryptographic principles, and mathematical foundations used in cryptography. (PO – 1,2,5 PSO –1,2,3)

CO2: Analyze and apply public key cryptography, RSA, cryptographic hash functions, and key exchange mechanisms. (PO – 1,2,3,4,5 PSO –1,2,3)

CO3: Understand and evaluate authentication protocols, key management techniques, and network security mechanisms. (PO – 1,2,3,4,5 PSO –1,2,3)

CO4: Analyze wireless, web security mechanisms, malware threats, firewalls, and intrusion detection/prevention systems. (PO – 1,2,3,4,5 PSO –1,2,3)

CO5: Understand cyber laws, IT Act provisions, digital signatures, cyber offences, and legal compliance requirements. (PO –1,2,6,7 PSO – 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 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.
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.Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition

2.Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindrakumar, Cengage learning

Reference Books:

1. Cryptography and Network Security- Behrouz A Forouzan, DebdeepMukhopadhyay, Mc-GrawHill, 3rd Edition, 2015

2.Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition

3. Cyber Law simplified- VivekSood, Mc-GrawHill, 11th reprint , 2013

Web links and Video Lectures(e-Resources):

- https://www.classcentral.com/course/youtube-cryptography-network-security-512455
- https://www.classcentral.com/course/youtube-network-security-diffie-hellman-key-exchange algorithm-189975
- https://freevideolectures.com/course/3027/cryptography-and-network-security

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

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

DATA WAREHOUSING AND DATA MINING			
Course Code	24IS55E	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	40 Theory + 20 Practical	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisite:

1. Database Management Systems (DBMS)
2. Basic Statistics and Probability
3. Data Structures

Course Learning 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 **8 hours**

Data Warehouse: Introduction to Data Ware House, Differences between operational data base 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.

Textbook 2: Ch.4.1,4.2

Module-2 **8 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.

Textbook 2: Ch.4.4
Textbook 1: Ch.1.1,1.2,1.4, 2.1 to 2.4

Module-3 **8 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.

Textbook 1: Ch 6.1,6.2,6.3, 6.5, 6.6 and 6.7

Module-4 **8 hours**

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

Textbook 1: Ch 4.3,4.6,5.1,5.2,5.3

Module-5 **8 hours**

Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering Algorithms.

Textbook 1: Ch 8.1 to 8.5, 9.3 to 9.5

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1.	Creating new Arff File
2.	Data Processing Techniques on Data set
3.	Data cube construction – OLAP operations
4.	Implementation of Apriori algorithm
5.	Implementation of FP- Growth algorithm
6.	Implementation of Decision Tree Induction
7.	Calculating Information gains measures
8.	Classification of data using Bayesian approach
9	Implementation of K-means algorithm
10.	Case Study: Create Placement.arff file to identify the students who are eligible for placements using KNN

Course Outcomes:

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

CO1. Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions. (PO1, 2 5 PSO –1,2,3)

CO2. Apply KDD process for finding interesting pattern from warehouse. (PO 2,4,5 PSO –1,2,3)

CO 3. Analyze the kinds of patterns that can be discovered by association rule mining. (PO1, 2 5 PSO –1,2,3)

CO4. Evaluate interesting patterns from large amounts of data to analyze for predictions and classification. (PO2,3,4,5 PSO –1,2,3)

CO5. Design selects suitable methods for data mining and analysis. (PO2,3,,5,12 PSO –12,3)

Assessment Details (both CIE and SEE):

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

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

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- 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:

Textbooks

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
3. The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.
4. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106093/
2. https://nptel.ac.in/courses/110/107/110107092/
3. https://nptel.ac.in/courses/106/105/106105174/
4. VTU e-Shikshana Program VTU EDUSAT Program

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

- Flip Class
- Seminar/Poster Presentation
- Role play/Team Demonstration/Collaborative Activity
- Mini Project
- Case study
- Learn by Doing

Business Intelligence			
Course Code	24IS56A	**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 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 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 **8 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.

Textbook 1: Chapter 1

Module-2 **8 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.

Textbook1: Chapter 2

Module-3 **8 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.

Textbook1: Chapter 5

Module-4 **8 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.

Textbook 1: Chapter 11

Module-5 **8 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.

Textbook 1: Chapter 12

PRACTICAL COMPONENT OF IPCC

Sl.No	Experiments
1	Import a Sales dataset (CSV/Excel) into Power BI Desktop and create the following visuals: • Card: Total Sales • Bar Chart: Sales by Region • Column Chart: Sales by Product • Table: Customer-wise Sales Create a single-page report summarizing overall sales performance.
2	Import a dataset containing missing and duplicate values. Perform the following using Power Query Editor: • Remove null values • Remove duplicate records

	• Change incorrect data types • Split a column (Full Name → First Name & Last Name) • Create a new column: Profit = Sales – Cost Load the cleaned dataset into Power BI.
3	Import multiple tables (Sales, Customer, Product, Date). • Create relationships between tables • Design a Star Schema data model • Verify relationships in Model View • Create a report showing Sales by Region and Category
4	Using DAX, create the following measures: • Total Sales • Total Cost • Total Profit • Profit Margin (%) • Average Sales per Customer Display the measures using KPI Cards and Table visual.
5	Create a What-If Parameter for Discount (0%–30%). • Create Adjusted Sales measure using DAX • Display results in a Line Chart • Use slicer to control discount • Analyze impact on Profit Demonstrate decision support capability.
6	Create an interactive dashboard including: • KPI Cards • Sales by Region (Bar Chart) • Monthly Sales Trend (Line Chart) • Category Distribution (Pie Chart) • Add slicers (Year, Region, Product Category) • Enable drill-down functionality
7	Using a Time-series Sales dataset: • Create Monthly Sales Line Chart • Enable Forecasting option in Analytics pane • Generate 6-month sales forecast • Analyze projected trend
8	Create a management report to: • Display Top 5 Customers by Sales • Apply Top N filter • Highlight Profit values using Conditional Formatting • Create dynamic title based on selected Region Provide insights for managerial decision-making.

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.(PO-1,2,3,5 PSO-1,2,3)

CO2: Describe the significance of 98 Computerized Decision Support, apply the basics of mathematics to understand the mathematical modelling behind decision support. (PO-1,2,3,5 PSO-1,2,3)

CO3: Explain Data warehousing, its architecture and Extraction, Transformation, and Load (ETL) Processes. (PO-1,2,3,5 PSO-1,2,3)

CO4: Analyze the importance of knowledge management and explain its activities, approaches and its implementation. (PO-1,2,3,5 PSO-1,2,3)

CO5: Describe the Expert systems and analyze its development, discuss areas suitable for application of expert's system. (PO-1,2,3,5 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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. 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.

Data Analytics with R			
Course Code	24IS56B	**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 on;

- Basic concepts of statistics such as mean, median, probability, and distributions.
- Programming concepts including variables, loops, conditional statements, and functions.
- Handling data files such as tables, spreadsheets, and CSV files.
- Basic computer usage skills including installing software and working with folders/files.

Course Objectives:

- Introduce the fundamentals of R programming and core data analytics concepts.
- Enable students to perform data preparation, manipulation, and exploratory data analysis using R.
- Provide knowledge of statistical analysis and modeling techniques for data-driven decision making.
- Develop skills in advanced analytics, predictive modeling, and machine learning using R.
- Expose learners to real-world data analytics applications, reporting, and ethical considerations.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Basics of R

Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops, Basic Data Types in R, Vectors

Text Book1: Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2

Module-2 **8 Hours**

Basics of R Continued

Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times

Text Book 1: Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.

Module-3 **8 Hours**

Data Preparation

Datasets, Importing and Exporting files, Accessing Databases, Data Cleaning and ,Transformation

Text Book 1: Chapter 3: 3.1,3.2,3.3,3.4

Module-4 **8 Hours**

Graphics using R

Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots, Histograms, Box Plots, Bar Plots, Other Graphical packages

Text Book 1: Chapter 4: 4.1 to 4.9

Module-5 **8 Hours**

Statistical Analysis using R

Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance

Text Book 1: Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1.	Demonstrate the steps for installation of R and R Studio. Perform the following: Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type. a. Demonstrate Arithmetic and Logical Operations with simple examples. b. Demonstrate generation of sequences and creation of vectors. c. Demonstrate Creation of Matrices. d. Demonstrate the Creation of Matrices from Vectors using Binding Function. e. Demonstrate element extraction from vectors, matrices and arrays
2.	Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics: a. Profit for each month. b. Profit after tax for each month (Tax Rate is 30%). c. Profit margin for each month equals to profit after tax divided by revenue. d. Good Months – where the profit after tax was greater than the mean for the year. e. Bad Months – where the profit after tax was less than the mean for the year. f. The best month – where the profit after tax was max for the year. g. The worst month – where the profit after tax was min for the year. **Note:** a. All Results need to be presented as vectors b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points c. Results for the profit margin ratio need to be presented in units of % with no decimal point. d. It is okay for tax to be negative for any given month (deferred tax asset) e. Generate CSV file for the data.
3.	Develop a program to create two 3 X 3 matrices A and B and perform the following operations a. Transpose of the matrix b. addition c. subtraction d. multiplication
4.	Develop a program to find the factorial of given number using recursive function calls.
5.	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.
6.	The built-in data set mammals contain data on body weight versus brain weight. Develop R

	commands to: a. Find the Pearson and Spearman correlation coefficients. Are they similar? b. Plot the data using the plot command. c. Plot the logarithm (log) of each variable and see if that makes a difference.
7.	Develop R program to create a Data Frame with following details and do the following operations <table><tr><th>Item Code</th><th>Item Category</th><th>Item Price</th></tr><tr><td>1001</td><td>Electronics</td><td>700</td></tr><tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr><tr><td>1003</td><td>Office Supplies</td><td>350</td></tr><tr><td>1004</td><td>USB</td><td>400</td></tr><tr><td>1005</td><td>CD Drive</td><td>800</td></tr></table>a. Subset the Data frame and display the details of only those items whose price is greater than or equal to 350. b. Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies" c. Create another Data Frame called "item-details" with three different fields item Code, Item Qtyon Hand and Item Reorder Lvl and merge the two frames
8.	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. a. Assigning names, using the air quality data set. b. Change colors of the Histogram c. Remove Axis and Add labels to Histogram d. Change Axis limits of a Histogram e. Add Density curve to the histogram
9	Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis. a. Find the total number rows & columns b. Find the maximum salary c. Retrieve the details of the employee with maximum salary d. Retrieve all the employees working in the IT Department. e. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"
10.	Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following: a. What is the total number of observations and variables in the dataset? b. Find the car with the largest hp and the least hp using suitable functions c. Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?

	d. What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations. e. Which pair of variables has the highest Pearson correlation?

Course outcomes (Course Skill Set):

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

CO1: Explain the R programming environment, data types, control structures, data preparation techniques, graphical packages, and basic statistical analysis using R. (PO-1,2,5,9,11 PSO-1,2,3)

CO2: Analyze and manipulate structured datasets using R packages and perform exploratory data analysis to identify patterns and relationships in data. (PO-1,2,3,4,5 PSO-1,2,3)

CO3: Apply statistical methods such as probability distributions, hypothesis testing, correlation, regression, and analysis of variance using R. (PO-1,2,3,4,5 PSO-1,2,3)

CO4: Design and implement predictive models and machine learning algorithms including classification, clustering, and model evaluation techniques using R. (PO-1,2,3,4,5,11 PSO-1,2,3)

CO5: Develop data visualization dashboards, generate analytical reports, interpret results, and apply data analytics solutions to real-world problems using R. (PO-1,2,3,4,5,11 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

CIE for the theory component of the 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. R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019

Reference Books:

1. An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)
2. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc

Web links and Video Lectures(e-Resources):

- https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
- http://www.tutorialspoint.com/r/r_tutorial.pdf
- https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
- https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
- https://www.w3schools.com/r/r_stat_data_set.asp
- https://rpubs.com/BillB/217355

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

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

Natural Language Processing			
Course Code	24IS56C	**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 on;

- Basic knowledge of programming concepts (preferably Python)
- Fundamentals of Data Structures and Algorithms
- Basic understanding of Probability and Statistics
- Familiarity with Machine Learning concepts is desirable

Course Objectives:

- Introduce the fundamental concepts, challenges, and applications of Natural Language Processing.
- Provide knowledge of linguistic structures, language modeling techniques, and grammatical frameworks used in NLP.
- Enable learners to understand and implement word-level, syntactic, and probabilistic models for text analysis.
- Expose students to information retrieval systems, lexical resources, and text classification techniques.
- Develop an understanding of machine translation models, evaluation techniques, and ethical considerations in NLP systems.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction: 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 model (unigram, bigram), Paninion Framework, Karaka theory.

Textbook 1: Ch. 1, Ch. 2

Module-2 **8 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: Ch. 3, Ch. 4.

Module-3 **8 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 **8 Hours**

Information Retrieval:
Design Features of Information Retrieval Systems, Information Retrieval Models - Classical, Non-classical, Alternative Models of Information Retrieval - Custer model, Fuzzy model, LSTM model, Major Issues in Information Retrieval.
Lexical Resources: WordNet, FrameNet, Stemmers, Parts-of-Speech Tagger, Research Corpora.
Textbook 1: Chapter 9, Chapter 12.

Module-5 **8 Hours**

Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in Low-Resource Situations, MT Evaluation, Bias and Ethical Issues.
Textbook 2: Chapter 13.

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
1.	Develop a program to preprocess a given text by performing tokenization and computing word frequency distribution to understand basic Natural Language Processing concepts.
2.	Develop a program to construct unigram and bigram language models from a given corpus and analyze the probability of word occurrences.
3.	Develop a program to identify patterns in text using regular expressions and implement spelling error detection and correction.
4.	Develop a program to perform Part-of-Speech tagging and syntactic parsing using Context-Free Grammar to analyze the grammatical structure of sentences.
5.	Develop a program to train a Naive Bayes classifier for text classification and test it on sample text data.
6.	Develop a program to perform sentiment analysis on a given text dataset using Naive Bayes classification and evaluate its performance.
7.	Develop a program to design a simple Information Retrieval system that retrieves relevant documents based on user queries.
8.	Develop a program to utilize lexical resources such as WordNet to extract synonyms, antonyms, and semantic relationships between words.
9.	Develop a program to implement a simple machine translation system using an encoder–decoder model for translating text from one language to another.
10.	Develop a program to evaluate machine translation output using appropriate evaluation metrics such as BLEU score.

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:
CO1: Explain the fundamentals of Natural Language Processing, linguistic knowledge, language modeling techniques, and applications including Indian language processing. (PO-1,2,5,6,11 PSO-1,2,3)
CO2: Analyze word-level and syntactic structures using regular expressions, finite-state automata, morphological parsing, and parsing algorithms. (PO-1,2,3,4,5,8 PSO-1,2,3)
CO3: Apply probabilistic models such as Naive Bayes for text classification and sentiment analysis tasks. (PO-1,2,3,4,5,8 PSO-1,2,3)

CO4: Evaluate information retrieval systems, retrieval models, and utilize lexical resources for text processing and analysis. (PO-1,2,3,4,5,6,8 PSO-1,2,3)

CO5: Understand and implement machine translation models, evaluate translation quality, and analyze bias and ethical issues in NLP systems. (PO-1,2,3,4,5,11 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

CIE for the theory component of the 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. 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. T V Geetha, “Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives”, Pearson, 2024.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer Academic Publishers.

Web links and Video Lectures(e-Resources):

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

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

Text Classification Game (15 Marks)

Objective: Learn supervised learning and text classification.
Activity: Provide students with a set of documents (e.g., movie reviews) labelled 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 (10 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.

Quantum Algorithms and Cryptography			
Course Code	24IS56D	**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 on;

- Basic linear algebra (vectors, matrices, eigenvalues)
- Probability and statistics fundamentals
- Discrete mathematics (sets, Boolean logic)
- Basic knowledge of classical algorithms and complexity

Course Objectives:

- Understand the principles of quantum mechanics relevant to quantum computation and quantum state representation.
- Analyze and design quantum circuits using quantum gates and reversible computation concepts.
- Explain fundamental quantum algorithms and their computational advantages over classical algorithms.
- Apply advanced quantum algorithms to solve complex computational problems efficiently.
- Understand quantum cryptographic principles and analyze the security of quantum communication protocols.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction to Quantum Computation:Limitations of classical computation, Postulates of quantum mechanics (computational view), Qubits and quantum states, Superposition and measurement, Bloch sphere representation, Composite quantum systems

Textbook :Chapter 1,2

Module-2 **8 Hours**

Quantum Gates and Quantum Circuits :Single-qubit quantum gates, Multi-qubit gates, Controlled operations (CNOT), Quantum circuits and circuit diagrams, Universal quantum gate sets, Reversible computation

Textbook :Chapter 4

Module-3 **8 Hours**

Fundamental Quantum Algorithms: Deutsch algorithm, Deutsch–Jozsa algorithm, Bernstein–Vazirani algorithm, Quantum parallelism, Quantum speed-up vs classical algorithms.

Textbook: Chapter 6

Module-4 **8 Hours**

Advanced Quantum Algorithms: Quantum Fourier Transform (QFT), Phase estimation, Shor's factoring algorithm, Grover's search algorithm, Complexity advantages of quantum algorithms.

Textbook : Chapter 5, 6

Module-5 **8 Hours**

Quantum Cryptography: Classical vs quantum cryptography, No-cloning theorem, Quantum key distribution (QKD), BB84 protocol, Security of quantum cryptographic protocols, Applications and limitations

Textbook :Chapter 12

PRACTICAL COMPONENT OF IPCC

Sl. No	Experiments
1.	Write a program to create and measure a single qubit using a quantum simulator.
2.	Write a program to demonstrate superposition using the Hadamard gate.
3.	Write a program to apply basic quantum gates (X, Y, Z) on a qubit and observe the output.
4.	Write a program to measure a qubit multiple times and display the measurement results.
5.	Write a program to create a two-qubit quantum circuit.
6.	Write a program to demonstrate quantum entanglement using Hadamard and CNOT gates.
7.	Write a program to simulate a quantum coin toss.
8.	Write a program to implement the Deutsch algorithm for a simple oracle.
9.	Write a program to implement Grover's algorithm for searching one marked element.
10.	Write a program to demonstrate the No-Cloning Theorem using quantum circuits.

Course outcomes (Course Skill Set):

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

CO1: Explain the foundations of quantum computation, qubits, and quantum state representations. (PO-1,2,11 PSO-1,2,3)

CO2: Design and analyze quantum circuits using quantum gates and universal gate sets. (PO-1,2,3,5,11 PSO-1,2,3)

CO3: Demonstrate understanding of fundamental quantum algorithms and quantum parallelism. (PO-1,2,3,11 PSO-1,2,3)

CO4: Analyze advanced quantum algorithms such as QFT, Shor's and Grover's algorithms for computational advantage. (PO-1,2,3,5,11 PSO-1,2,3)

CO5: Explain quantum cryptographic protocols and evaluate their security compared to classical cryptography. (PO-1,2,6,7,11 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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:

"*Quantum Computation and Quantum Information*", Michael A. Nielsen, Isaac L. Chuang, 10th Anniversary Edition (also commonly referred to as 2nd Edition), Cambridge University Press, 2010(ISBN-13: 978-1107002173)

Reference Book:

1. "Quantum Computing: A Gentle Introduction",Eleanor G. Rieffel & Wolfgang H. Polak, The MIT Press, 2014,**ISBN: 978-0262526678**
2. "Quantum Computing for Computer Scientists", Noson S. Yanofsky & Mirco A. Mannucci, Cambridge University Press, 2008 ,**ISBN:** 978-0521879965
3. "Quantum Computing & Techniques (Theory & Practice)", Rajiv Chopra, Khanna Publishing House, 2024, **ISBN: 978-9355384232**

Web links and Video Lectures(e-Resources):

- https://learning.quantum.ibm.com/?utm_source=chatgpt.com
- https://www.ibm.com/quantum/qiskit/?utm_source=chatgpt.com
- https://wizape.com/English/Introduction-to-Quantum-Cryptography?utm_source=chatgpt.com
- https://www.iqmacademy.com/?utm_source=chatgpt.com
- https://github.com/MonitSharma/Learn-Quantum-Computing-For-Free?utm_source=chatgpt.com

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

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

ENVIRONMENTAL STUDIES AND E WASTE MANAGEMENT (CSE AND ALLIED BRANCH ONLY)			
Course Code	**24ES57**	**CIE Marks**	100
Teaching Hours/Week (L: T: P)	1:0:0	**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. **Text Book 1**: CH- 3, e-resource:1	
Module-2	**2 hrs**
Natural resources and Energy Natural Resources: Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water. Energy: Different types of energy, Conventional sources & Non - Conventional sources of Energy, Solar energy, Wind Energy, Hydrogen as an alternative energy Self-Study Component (SSC): Alternative Energy sources **Textbook 1**: CH- 2	
Module-3	**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)

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.

Suggested Learning Resources:

Text Book:

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

Reference Books

1.EarchBarucha, "Environmental Studies for UG students", 2004.
2.Benny Joseph (2005), "Environmental Studies" , Tata McGraw – Hill Publishing Company Limited.
3.R. Rajagopalan, "Environmental Studies- From Crisis to Cure" , 2nd Edition, Oxford university press, New Delhi, 2013.

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=VYVriv2vWxE
- https://www.youtube.com/watch?v=yxA6ilJp5fk
- https://www.youtube.com/watch?v=Ccu_wQqT1kA
- https://www.youtube.com/watch?v=hqq4waDUrnk
- https://www.youtube.com/watch?v=RQSM4Z-hgUo
- https://www.youtube.com/watch?v=oepriQ_TOLo
- https://www.youtube.com/watch?v=qS8mfAX1tAk
- NPTEL materials

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

- Field Visits
- Quiz/Assignments/Open book test to develop skills
- Encourage collaborative learning in the class
- Demonstration of Geological models and animations
- Hands on experiments with Rock and Minerals

VI Semester

BE in Information Science & Engineering
Scheme of Teaching VI Semester
Outcome Based Education and Choice Based Credit System (CBCS)
Effective from the academic year Batch - 2024-28

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)/ Board	Teaching Hours /Week			Examination			
					Theory	Tutorial	Practical	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1	PCC	24IS61	AI & Machine Learning	ISE	3	0	0	50	50	100	3
2	IPCC	24IS62	Software Testing	ISE	3	0	2	50	50	100	4
3	PCCL	24ISL63	Machine Learning Lab	ISE	0	0	2	50	50	100	1
4	PEC	24IS64X	Program Elective Course- 3	ISE	3	0	2	50	50	100	4
5	AEC	24RM65	Research Methodology and IPR	ISE	3	0	0	50	50	100	3
6	OEC	24XX66X	Open-Elective -1	Concerned Dept	3	0	0	50	50	100	3
7	PROJ	24IS67	Mini Project	ISE	0	0	4	100	-	100	2
8	NCMC	24NS68/ 24PE68/ 24YO68	NSS/YOGA/ PE	NSS/ YOGA/ PE Coordinator	0	0	2	100	-	100	-
9	NCMC	24IKS69	Indian Knowledge System	ISE	1	0	0	100	-	100	-
Total								**600**	**300**	**900**	**20**

Program Elective Course-3			
24IS64A	Integrated Full Stack Application Development	24IS64C	Generative AI
24IS64B	Big Data Analytics	24IS64D	Incident Response and Management

Open Elective Course-1			
24IS66A	Introduction to Data Structures	24IS66C	Introduction to Artificial Intelligence
24IS66B	Fundamentals of Operating Systems	24IS66D	Mobile Application Development

AI & Machine Learning			
Course Code	24IS61	**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 of

- Python
- Probability
- Trees
- Graphs
- Propositional & Predicate Logic.

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)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

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

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 1- 1.1, Chapter 2- 2.1, 2.2, 2.3, 2.4, Chapter 3- 3.1, 3.2, 3.3, 3.4**

Module-2 **8 Hours**

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search.

Adversarial Search: Games, Optimal decision in games, Alpha-Beta Pruning.

Logical Agents: Knowledge–based agents, The Wumpus world.

Propositional Logic: A very simple logic.

First Order Logic: Syntax and Semantics of First Order logic, Using First Order logic.

Text book 1: Chapter 3- 3.5, 3.6; Chapter 4 – 4.1, 4.2; Chapter 7- 7.1, 7.2, 7.4; Chapter 8- 8.2, 8.3

Module-3 **8 Hours**

Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

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 9- 9.1, 9.2, 9.3, 9.4, 9.5; Chapter 12-12.1, 12.2, 12.3, 12.4, 12.5
Text Book 2: Chapter 20

Module-4 **8 Hours**

Overview of Machine Learning: Introduction, What Is Machine Learning? Examples of Machine Learning Applications: Association Rules, Classification, Regression, Unsupervised Learning, Reinforcement Learning.

Text Book 3: Chapter 1 - 1.1, 1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.3

Module-5 **8 Hours**

Supervised Learning: Learning a Class from Examples, Vapnik - Chervonenkis Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Text Book 3: Chapter 2- 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8

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

CO1: Develop the structure and behavior of intelligent agents and apply uninformed search algorithms, including iterative deepening, to solve computational problems. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO2: Apply informed search strategies and logical reasoning methods to design intelligent decision-making agents. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO3: Apply inference techniques in first-order logic and probabilistic reasoning, to develop knowledge-based and expert systems for intelligent decision-making. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO4: Describe the fundamental concepts of machine learning and distinguish between key learning paradigms, with real-world examples. (PO – 1,2,3,5,11, PSO – 1,2,3)

CO5: Apply the principles of supervised learning to build models for classification and regression, and evaluate their performance using theoretical and empirical metrics. (PO – 1,2,3,5,11, PSO – 1,2,3)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation(CIE):

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

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

Semester-End Examination: 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. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbooks:

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.
3. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 2021.

Reference Books:

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

Web links and Video Lectures(e-Resources):

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

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

- Flipped classroom
- Assessment Methods
  - Case Study
  - Programming Assignment
  - Gate Based Aptitude Test

SOFTWARE TESTING			
Course Code	24IS62	**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 on;

- Basic Knowledge of programming
- Software Engineering Fundamentals

Course Objectives:

- Explain different testing techniques
- Differentiate the various testing techniques.
- Apply suitable technique for designing of flow graph.
- Analyze the problem and derive suitable test cases

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Basics of Software Testing: Humans, Errors and Testing, Software Quality, Requirements Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test Metrics, Testing and Verification, Test-generation Strategies, Static Testing.

A Perspective on Testing: Definitions, Test Cases, Insights from Venn Diagram, Identifying Test Cases, Error and fault taxonomies, Levels of testing.

Examples: Generalized pseudocode, the Triangle problem, the NextDate function, the Commission problem, the SATM system, the Currency converter, Saturn windshield wiper

Textbook 1:**Ch1,Ch2 Textbook 2**:**Ch. 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.8, 1.11, 1.12**

Module-2 **8 Hours**

Functional Testing: Boundary Value Testing - Boundary value analysis, Robustness testing, Worst-case testing, Special Value Testing, Examples, Random Testing, Guidelines.

Equivalence Class Testing - Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations,

Decision Table Based Testing - Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

Text book 1: Ch. 5, 6, 7

Module-3 **8 Hours**

Structural Testing: Overview, Statement testing, Program testing, Condition testing,

Path testing - DD paths, Test coverage metrics, Basis path testing, guidelines and observations,

Dataflow testing: Definition-Use testing, Slice-based testing, Guidelines and observations.

Textbook 1: Ch 9,10 Textbook 2:Ch. 6.2.1, 6.2.4

Module-4 **8 Hours**

Levels of Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing.

Integration Testing: A closer look at the SATM system, Decomposition-based, call graph-based, Pathbased integrations.

Textbook 1: Ch. 12 & 13.1,13.2,13.3,13.4

Module-5 **8 Hours**

System Testing: Threads, Requirement Specification, Finding Threads, Structural strategies for thread tesing, SATM test threads System testing guidelines, ASF testing example.

Interaction Testing: Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing

Textbook 1: Ch 14,15

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.
2.	Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.
3.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.
4.	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, equivalence class partitioning and decision-table approach and execute the test cases and discuss the results
5.	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.
6.	Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results
7.	Develop a Mini Project with documentation of suitable test-cases and their results to perform automation testing of anyE-commerce or social media web page. Suggested Guidelines: ● Create a WebDriver session. ● Navigate to a Web page. ● Locate the web elements on the navigated page. ● Perform an actions on the located elements. ● Assert the performed actions did the correct thing. ● Report the results of the assertions. ● End the session. Each inputs / data feeds (ex: website, username, password, mobile no, product name, etc.,)must be provided through a file linked with code and neither to be entered manually nor to be included in the code Use any software testing tool like selenium, Katalon, etc.,

Course outcomes (Course Skill Set):

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

CO1:.Explain the significance of software testing and quality assurance in software development (PO – 1,2,6 PSO – 1,2)

CO2: Apply the concepts of software testing to assess the most appropriate testing method. (PO **-1,2,3,5** PSO – 1,3)

CO3: Analyze the importance of testing in software development.(PO – 1,2,6,10 PSO – 1,2)

CO4: Evaluate the suitable testing model to derive test cases for any given software (PO –1,2,3,4,5 PSO –1,3)

CO5: Develop appropriate document for the software artefact.(PO – 3,9,10 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 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.

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. Paul C. Jorgensen: Software Testing, A Craftsman‟s Approach, 3rd Edition, Auerbach Publications, 2008.
2. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008

Reference Books:

1. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
2. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2 nd Edition, Pearson, 2007.
3. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
4. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
5. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015.

Web links and Video Lectures(e-Resources):

1. https://nptel.ac.in/courses/106/105/106105150/
2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
3. https://www.youtube.com/watch?v=OGImfxO2TEU&t=10s
4. https://www.youtube.com/watch?v=Q50ZyydS7pI

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

- Flip Class
- Seminar/Poster Presentation
- Role play/Team Demonstration/Collaborative Activity
- Mini Project
- Case study
- Learn by Doing

Machine Learning Lab			
Course Code	24ISL63	**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**	2
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. **Book 1: Chapter 2**

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. **Book 1: Chapter 2**
3.	Develop a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2. **Book 1: Chapter 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. **Book 1: Chapter 3**
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 $k=1,2,3,4,5,20,30$ **Book 2: Chapter 2**
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. **Book 1: Chapter 4**
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. **Book 1: Chapter 5**
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. **Book 2: Chapter 3**
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. **Book 2: Chapter 4**
10.	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result. **Book 2: Chapter 4**

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 – 1,2,3)

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

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

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

Assessment Details (both CIE and SEE)

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

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 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.

● 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 average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student

Semester End Evaluation (SEE):

● SEE marks for the practical course are 50 Marks.

● 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. Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

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

Integrated Full Stack Application Development			
Course Code	24IS64A	**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 on;

- Basic knowledge of HTML and CSS
- Fundamentals of Programming Concepts
- Basic understanding of Web Technologies
- Introductory knowledge of Databases and Computer Networks

Course Objectives:

CLO1: To introduce core JavaScript syntax, data types, control structures, functions, and object-based programming for web development.

CLO2: To understand and apply DOM manipulation, event handling techniques for interactive web applications.

CLO3: To introduce MERN stack architecture and develop React components using properties, composition, and dynamic data flow.

CLO4: To design state-driven React applications and implement backend services using Express, REST APIs, and GraphQL.

CLO5: To develop data-driven web applications using MongoDB with Node.js and optimize applications using modularization and Webpack.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

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

Text Book 1: Chapter 2, 3, 4

Module-2 **8 Hours**

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

Text Book 1: Chapter: 5, 6, 13

Module-3 **8 Hours**

Introduction to MERN: MERN components, Server less Hello world. React Components: Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

Text Book 2: Chapter 1, 2, 3

Module-4 **8 Hours**

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

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

Text Book 2: Chapter 4, 5

Module-5 **8 Hours**

MongoDB: Basics, Documents, Collections, Databases, Query Language, Installation, The Mongo Shell, MongoDB CRUD Operations, Create, Read, Projection, Update, Delete, Aggregate, MongoDB Node.js Driver, Schema Initialization, Reading from MongoDB, Writing to MongoDB. Modularization and Webpack ,Back-End Modules Front-End Modules and Webpack Transform and Bundle, Libraries Bundle ,Hot Module Replacement, Debugging DefinePlugin: Build Configuration, Production Optimization.

Text Book 2: Chapter 6, 7

PRACTICAL COMPONENT OF IPCC

Sl. No	Experiments
1.	a. Write a script that Logs "Hello, World!" to the console. Create a script that calculates the sum of two numbers and displays the result in an alert box. b. Create an array of 5 cities and perform the following operations: Log the total number of cities. Add a new city at the end. Remove the first city. Find and log the index of a specific city.
2.	Read a string from the user, Find its length. Extract the word "JavaScript" using substring() or slice(). Replace one word with another word and log the new string. Write a function isPalindrome(str) that checks if a given string is a palindrome (reads the same backward).
3.	Create an object student with properties: name (string), grade (number), subjects (array), displayInfo() (method to log the student's details) Write a script to dynamically add a passed property to the student object, with a value of true or false based on their grade. Create a loop to log all keys and values of the student object.
4.	Create a button in your HTML with the text "Click Me". Add an event listener to log "Button clicked!" to the console when the button is clicked. Select an image and add a mouseover event listener to change its border color. Add an event listener to the document that logs the key pressed by the user.
5.	Build a React application to track issues. Display a list of issues (use static data). Each issue should have a title, description, and status (e.g., Open/Closed). Render the list using A functional component.
6.	Create a component Counter with A state variable count initialized to 0. Create Buttons to increment and decrement the count. Simulate fetching initial data for the Counter component using useEffect (functional component) or componentid count (class component). Extend the Counter component to Double the count value when a button is clicked. Reset the count to 0 using another button.
7.	Install Express (npm install express). Set up a basic server that responds with "Hello, Express!" at the root endpoint (GET /). Create a REST API. Implement endpoints for a Product resource: GET : Returns a list of products. POST : Adds a new product. GET /:id: Returns details of a specific product. PUT /:id: Updates an existing product. DELETE /:id: Deletes a product. Add middleware to log requests to the console. Use express.json() to parse incoming JSON payloads.
8.	Install the MongoDB driver for Node.js. Create a Node.js script to connect to the shop database. Implement insert, find, update, and delete operations using the Node.js MongoDB driver. Define a product schema using Mongoose. Insert data into the products collection using Mongoose. Create an Express API with a /products endpoint to fetch all products. Use fetch in React to call the /products endpoint and display the list of products. Add a POST /products endpoint in Express to insert a new product. Update the Product List, After adding a product, update the list of products displayed in React.

Course outcomes (Course Skill Set):

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

CO1: Apply JavaScript fundamentals to develop dynamic and interactive web pages. (PO-1,2,3,5 PSO-1,2,3)

CO2: Manipulate the DOM and handle events to enhance user interaction and form validation. (PO-1,2,3,4,5 PSO-1,2,3)

CO3: Develop React-based front-end applications using component composition and data flow. (PO-1,2,3,4,5 PSO-1,2,3)

CO4: Implement backend services using Express, REST APIs, and GraphQL with effective state management. (PO-1,2,3,4,5 PSO-1,2,3)

CO5: Design full-stack applications using MongoDB, Node.js, and modern build tools such as Webpack. (PO-1,2,3,4,5 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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. Jon Duckett, "JavaScript & jQuery: Interactive Front-End Web Development", Wiley, 2014.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React and Node. Apress, 2019

Web links and Video Lectures(e-Resources):

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

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

- Role Play
- Flipped classroom
- Assessment Methods for 25 Marks (opt two Learning Activities)
    - Case Study
    - Programming Assignment
    - Gate Based Aptitude Test
    - Course Project: Build Web applications using MERN stack. Students (group of 2) can choose any real world problem from domains such as finance, marketing, medical, or enterprise projects

Big Data Analytics			
Course Code	24IS64B	**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 on;

- Basic programming concepts such as variables, loops, and conditional statements.
- Fundamentals of databases including tables, keys, and basic SQL operations.
- Basic concepts of data structures and file systems.
- Understanding of data and statistics fundamentals is desirable.

Course Objectives:

- Introduce the fundamentals of Big Data, its characteristics, evolution, and the need for Big Data Analytics.
- Provide knowledge of Big Data architectures and technologies including Hadoop, HDFS, YARN, and MapReduce.
- Enable learners to understand NoSQL databases and perform data storage and querying using MongoDB.
- Expose students to Big Data processing tools such as Hive and Pig for structured and semi-structured data analytics.
- Develop skills in advanced Big Data analytics using Spark and web/text analytics techniques.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction: 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.

Text Book1: Chapter 1: 1.1, Chapter 2: 2.1-2.5,2.7,2.9-2.11, Chapter 3: 3.2,3.5,3.8,3.12, Chapter 4: 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.

Text Book1: Chapter 5: 5.1-,5.8, 5.10-5.12, Chapter 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.

Text Book1: Chapter 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.

Text Book1: Chapter 9: 9.1-9.6,9.8, Chapter 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: Chapter 5: 5.2,5.3, Chapter 9: 9.1-9.4

PRACTICAL COMPONENT OF IPCC

Sl. No.	Experiments
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: Explain the concepts of Big Data, its characteristics, evolution, analytics classifications, and differences between traditional data warehousing and Big Data systems. (PO-1,2,5 PSO-1,2,3)

CO2: Analyze Big Data architectures and implement data storage and processing using Hadoop components such as HDFS, YARN, and MapReduce. (PO-1,2,3,4,5 PSO-1,2,3)

CO3: Apply NoSQL database concepts and perform data modeling, storage, and querying using MongoDB. (PO-1,2,3,4,5 PSO-1,2,3)

CO4: Use Hive and Pig frameworks to perform Big Data querying, processing, and analytics on large datasets. (PO-1,2,3,4,5 PSO-1,2,3)

CO5: Implement Big Data analytics using Spark and analyze text and web data using web mining and link analysis techniques. (PO-1,2,3,4,5 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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- 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.
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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=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ
- https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&in dex=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 [10 marks]

Generative AI			
Course Code	24IS64C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:2	**SEE Marks**	50
Credits	4	**Total Marks**	100
Contact Hours	40 Theory + 20 Practical	**Exam Hours**	3
Examination type (SEE)	**Theory**		

Prerequisites:

The students should have knowledge on

- Basics of Python Programming
- Fundamentals of Machine Learnings
- Linear Algebra & Probability (recommended)

Course Objectives:

- Understand the fundamental principles of generative modeling and differentiate between discriminative and generative approaches.
- Analyze and implement deep generative architectures such as Autoencoders, Variational Autoencoders (VAE), and Generative Adversarial Networks (GANs).
- Examine transformer-based architectures and Large Language Models (LLMs) for text generation and related applications.
- Apply advanced techniques such as diffusion models, prompt engineering, fine-tuning, and Retrieval-Augmented Generation (RAG) in real-world scenarios.
- Evaluate ethical, security, and regulatory challenges associated with Generative AI systems and propose responsible AI solutions.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction to Generative AI

Artificial Intelligence, Machine Learning and Deep Learning overview; Discriminative vs Generative models; Probability distributions and latent space representation; Introduction to foundation models; Applications of Generative AI (Text, Image, Audio, Video); Ethical concerns, AI governance and responsible AI practices.

Text Book 1:Chapter1,2

Module-2	8 Hours

Generative Models – Auto encoders and GANs

Auto encoders and Variational Auto encoders (VAE); Latent variable modeling; Generative Adversarial Networks (GAN); DCGAN, Conditional GAN; Training challenges – Mode collapse, vanishing gradients; Implementation concepts using PyTorch/TensorFlow.

Text Book 1:Chapter3,4

Module-3	8 Hours

Transformers and Large Language Models

Attention mechanism; Transformer architecture; BERT and GPT models; Tokenization techniques; Pre-training and Fine-tuning; Instruction tuning and Reinforcement Learning from Human Feedback (RLHF).

Text Book 2:Chapter1,2,3,4,10

Module-4	8 Hours

Diffusion Models and Advanced Techniques

Denoising diffusion probabilistic models; Stable Diffusion; Text-to-image generation; Parameter Efficient Fine-Tuning (LoRA, PEFT); Retrieval Augmented Generation (RAG); Model alignment strategies.

Text Book 1:Chapter5, 6

Module-5	8 Hours

Applications, Deployment and Ethics

Prompt engineering techniques; Chatbot development; Content generation systems; API-based model deployment; Bias, hallucination, fairness; Regulatory frameworks and AI safety standards.

Text Book 2:Chapter8,9

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1	Write a Python program to generate and visualize different probability distributions (Normal, Uniform, Bernoulli). Create a 2D latent space representation and visualize how data points are distributed in the latent space using matplotlib or seaborn.
2	Implement a basic Autoencoder using PyTorch or TensorFlow to reconstruct the MNIST dataset. Train the model and compare original and reconstructed images.
3	Develop a Variational Autoencoder (VAE) model for image generation using the MNIST dataset. Visualize the latent space and generate new synthetic images by sampling from the latent distribution.
4	Implement a basic GAN architecture to generate handwritten digit images. Train the Generator and Discriminator networks and analyze training stability.

5	Develop a Conditional GAN (cGAN) that generates images based on class labels. Evaluate how conditioning improves generation quality.
6	Implement a simplified self-attention mechanism in Python and demonstrate how attention weights are calculated for a given input sequence.
7	Use a pre-trained transformer model (BERT or GPT) from Hugging Face and fine-tune it for a text classification task. Evaluate model performance using accuracy and F1-score.
8	Use a pre-trained GPT model to generate text based on a given prompt. Experiment with different temperature and max length parameters to analyze output variation.
9	Develop a simple Retrieval-Augmented Generation (RAG) pipeline using a document dataset. Implement document embedding, retrieval, and answer generation using a transformer model.
10	Develop a simple chatbot using a pre-trained language model API (e.g., OpenAI / Hugging Face). Implement prompt engineering techniques and analyze the model response for bias, hallucination, and fairness issues.

Course outcomes (Course Skill Set):

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

CO1: Explain fundamental principles of generative models. (PO-1,2,11 PSO-1)

CO2: Implement GANs and VAEs for synthetic data generation. (PO-2,3,5 PSO-1,2)

CO3: Analyze transformer and LLM architectures. (PO-1,2,4 and PSO-1)

CO4: Develop generative AI applications using modern tools. (PO-3,5,9 PSO-2)

CO5: Evaluate ethical implications of generative AI systems. (PO-6,810 PSO-1)

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 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.
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:

Text Books:

1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, 2022.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
3. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly, 2022.

Reference Books:

1. Sebastian Raschka, Machine Learning with PyTorch and Scikit-Learn, Packt, 2022.

2. Andriy Burkov, The Hundred-Page Machine Learning Book, 2019.
3. Official documentation – OpenAI, HuggingFace (latest versions).

Web links and Video Lectures(e-Resources):

- https://www.youtube.com/watch?v=HEHUpBO8UVc&list=PLA1lVIthbM1D5I6r5uY2K89X1KD2w5LNh
- https://www.youtube.com/watch?v=dI8EQU0PFzc&list=PLv8Cp2NvcY8AzNCATbDWMr8vqbJBYbxFW
- https://www.youtube.com/watch?v=V9tJCQoBakA&list=PLQxDHpeGU14AIu52l2OlIJs9z94yTFR_t

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

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

Incident Response and Management			
Course Code	24IS64D	**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 on;

- Basic knowledge of Computer Networks
- Fundamentals of Cyber Security
- Understanding of Operating Systems
- Introductory knowledge of Information Security concepts
- Basic familiarity with system logs and networking tools (desirable)

Course Objectives:

- To understand incident response concepts, forensic principles, and the role of incident response in cybersecurity operations.
- To apply preparation and identification techniques including malware analysis, logging, threat intelligence, and incident classification.
- To analyze containment and eradication strategies for minimizing damage and removing cyber threats effectively.
- To implement secure recovery processes and perform post-incident analysis for continuous improvement.
- To apply advanced network defense frameworks and manage incident response operations within a cybersecurity operations center.

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction: Definitions of incident response and forensic analysis, relation of incident response to the rest of cybersecurity operations, incident response phases - preparation, identification, containment, eradication, recovery, follow-up, indicators of compromise (IOC), forensic analysis as an incident response tool and as support for cybercrime investigations, cybersecurity forensics principles.

Text Book 1: Chapter 1

Module-2 **8 Hours**

Preparation: Policies and procedures, incident workflows, guidelines, incident handling forms, principles of malware analysis, log analysis, threat intelligence, vulnerability management, penetration testing, digital forensics, incident ticketing systems, incident documentation templates. Identification: Detection, incident triage, information gathering and reporting, incident classification, indicators of compromise (IOC)

Text Book 1: Chapter: 2,3

Module-3 **8 Hours**

Containment: Damage limitation, network segment isolation, system isolation, forensic backup and imaging, use of write blockers, temporary fixes, malware spread limitation. Eradication: Actual removal and restoration of affected systems, removal of attack artifacts, scanning of other systems to ensure complete eradication, use of IOCs on other systems and local networks, cooperation with forensic analysis to understand the attack fully.

Text Book 1: Chapter: 4,5

Module-4 **8 Hours**

Recovery: Test and validate systems before putting back into production, monitoring of system behavior, ensuring that another incident will not be created by the recovery process. Follow-up: Documenting lessons learned, preparatory activities for similar future incidents, technical training, process improvement

Text Book 1: Chapter 6,7

Module-5 **8 Hours**

Advanced computer network defense: vulnerability and threat management, threat intelligence and situational awareness, tools and processes, frameworks (ATT&CK, Cyber Kill Chain, etc.), threat hunting, information sharing ,Planning and running incident response team exercises

Text Book 2: Strategy 1 to Strategy 10

PRACTICAL COMPONENT OF IPCC

Sl. No	Experiments
1	Develop a Python program to simulate the Incident Response Lifecycle, displaying response phases based on incident type.
2	Write a Python script to extract Indicators of Compromise (IOCs) such as IP addresses, URLs, and file hashes from a given log file.
3	Develop a Python log-analysis program to detect suspicious activities in system or server log files using predefined rules.
4	Create a Python-based simulation program to demonstrate containment actions such as system or network isolation based on incident severity.
5	Write a Python or PowerShell script to monitor system resource usage and report anomalies during the recovery phase.
6	Develop a Python program to automatically generate an incident response report including timeline, actions taken, and lessons learned.
7	Develop a Python-based threat-hunting program to correlate logs from multiple sources and identify hidden attack patterns.
8	Design a Python simulation tool to conduct an incident response tabletop exercise, assigning roles and tracking response time.

Course outcomes (Course Skill Set):

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

CO1: Explain incident response processes and forensic principles in cybersecurity operations. (PO-1,2,5 PSO-1,2,3)

CO2: Apply preparation and identification techniques to detect and classify security incidents. (PO-1,2,3,4,5 PSO-1,2,3)

CO3: Implement containment and eradication strategies to minimize and remove cyber threats. (PO-1,2,3,4,5 PSO-1,2,3)

CO4: Perform system recovery and post-incident analysis to prevent future incidents. (PO-1,2,3,4,5 PSO-1,2,3)

CO5: Apply advanced defense frameworks and manage incident response teams effectively. (PO-1,2,3,4,5,7,8,9 PSO-1,2,3)

Assessment Details (both CIE and SEE):

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

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

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for 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.
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:

Textbooks:

1. Jason T. Luttgens and Matthew Pepe, "Incident Response & Computer Forensics, Third Edition"
2. Ten Strategies of a World-Class Cybersecurity Operations Center, Carson Zimmermann, The MITRE

Corporation, 2014. Free e-book available from https://www.mitre.org/publications/all/ten-strategies-of-a-world-class-cybersecurity-operations-center.

References:

1.Don Murdoch, "Blue Team Handbook: Incident Response Edition: A condensed field guide for the Cyber Security Incident Responder".
2. Leighton Johnson, "Computer Incident Response and Forensics Team Management: Conducting a Successful Incident Response"

Web links and Video Lectures(e-Resources):

- https://www.classcentral.com/course/youtube-introduction-to-the-mitre-att-ck-framework-307762?utm_source=chatgpt.com
- https://www.classcentral.com/course/youtube-mitre-att-ck-framework-for-offensive-defensive-operations-174692?utm_source=chatgpt.com
- https://www.classcentral.com/course/youtube-what-is-cyber-threat-hunting-and-dfir-steps-of-malware-attack-explained-308042?utm_source=chatgpt.com
- https://redcanary.com/resources/webinars/threat-hunting-with-attck-3-part-webinar-series/?utm_source=chatgpt.com

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

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

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

Prerequisites:

The students should have knowledge on;

- Understanding of your **core subject/discipline** (Engineering, Science, Commerce, Arts, etc.)
- Familiarity with **technical terminology** of your field
- Ability to read and understand **academic papers or textbooks**

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 learn Ethics in Engineering Research.
- To Discuss the concepts of Intellectual Property Rights in engineering.
- To understand legal and ethical responsibilities in research

Teaching-Learning Process (General Instructions)

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods may be adopted to attain the outcomes.
2. Use of video/animation to explain the functioning of various concepts.
3. Encourage collaborative (group learning) in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class to promote critical thinking.
5. Adopt Problem Based Learning (PBL) to foster students' analytical and design thinking skills such as designing, evaluating, generalizing, and analyzing information rather than simple recall.
6. Use animations/videos to help students understand concepts.
7. Demonstrate concepts using a suitable programming language.

Module-1 **8 Hours**

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem.

Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Text Book1: Chapter 1

Module-2 **8 Hours**

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.

Text Book1: **Chapter 2,3**

Module-3 **8 Hours**

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting.

Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained? Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.

Text Book1: **Chapter4,5,6**

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.

Text Book 1: Chapter 7,8

Module-5 **8 Hours**

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**

Text Book1: **Chapter 9,10,11**

Course outcomes (Course Skill Set):

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

CO1: To know the meaning of engineering research. (PO-1,2,7,11 PSO-1,2)

CO2: To know the procedure of the literature Review and Technical Reading. (PO-1,2,7,11 PSO-1,2)

CO3: To understand the fundamentals of the patent laws and drafting procedure. (PO-1,2,7,11 PSO-1,2)

CO4: Understanding the copyright laws and subject matters of copyrights and designs. (PO-1,2,7,11 PSO-1,2)

CO5: Under standing the basic principles of design rights. (PO-1,2,7,11 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):

● 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 as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

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

Suggested Learning Resources:

Textbook:

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

Reference Book:

1.1 David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4

2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

Web links and Video Lectures(e-Resources):

- https://onlinecourses.swayam2.ac.in/ntr25_ed93/preview
- https://www.classcentral.com/course/swayam-research-methodology-and-ipr-275437
- https://www.jntuasite.in/syllabus-of-research-methodology-intellectual-property-rights/
- https://www.eeeonline.org/rm4151-research-methodology-and-ipr-syllabus-anna-university-pg-syllabus-regulation-2021/
- https://gvpce.ac.in/MECHANICAL/R-2022/syllabus/22HM2101.pdf

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

- Quizzes
- Assignments
- Seminars

INTRODUCTION TO DATA STRUCTURES			
Course Code	24IS66A	**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.

- Basics of C programming
- Variables, data types, operators, and control statements
- Functions and arrays
- Basic understanding of memory concepts

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. Ask 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**

Arrays: Introduction, One-Dimensional Arrays, Two-Dimensional Arrays, Initializing Two- Dimensional Arrays, Multidimensional arrays.

Pointers: Introduction, Pointer Concepts, Accessing Variables through Pointers, Pointer Applications, Dynamic Memory Allocation Functions.

Structures and Unions: Introduction, Declaring Structures, Giving Values to Members, Structure

Initialization, Comparison of Structure Variables, Arrays of Structures, Arrays within Structures, Nested Structures, Unions, Size of Structures.

Textbook 1: Ch. 8.1 to 8.5, Ch. 12.1 to 12.8, 12.10, 12.11.
Textbook 2: Ch. 2.1 to 2.3, 2.5, 2.9.

Module-2 **8 Hours**

Stacks: Introduction, Stack Operations, Stack Implementation using Arrays, Applications of Stacks.

Queues: Introduction, Queue Operations, Queue Implementation using Arrays, Different Types of Queues: Circular Queues, Double-Ended Queues, Priority Queues, Applications of Queues.

Textbook 2: Ch. 6.1 to 6.3, Ch. 8.1 to 8.2.

Module-3 **8 Hours**

Linked Lists: Introduction, Singly Linked List, Self-Referential Structures, Operations on Singly Linked Lists: Insert-Delete-Display, Implementation of Stacks and Queues using Linked List, Concatenate two Lists, Reverse a List without Creating a New Node, Static Allocation Vs Linked Allocation.

Circular Singly Linked List: Introduction, Operations: Insert-Delete-Display.

Textbook 2: Ch. 9.1 to 9.2, 9.3 (Only 9.3.1 to 9.3.5, 9.3.11 to 9.3.12), 9.4 to 9.5.

Module-4 **8 Hours**

Trees: Introduction, Basic Concepts, Representation of Binary Trees, Operations on Binary Trees: Insertion-Traversals-Searching-Copying a Tree, Binary Search Trees, Operations on Binary Search Trees: Insertion-Searching-Find Maximum and Minimum Value-Count Nodes, Expression Trees.

Textbook 2: Ch. 10.1 to 10.4, 10.5 (Only 10.5.1, 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.

Textbook 1: Ch. 17.1, 17.2.6, 17.3.2.
Textbook 2: Ch. 11.1 to 11.3, 11.10.1.

Course outcomes (Course Skill Set):

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

CO1: Explain and differentiate between primitive and non-primitive data structures. (PO-1,2 PSO-1)

CO2: Demonstrate the working of linear data structures such as arrays, stacks, queues, and linked lists using C. (PO-1,2 PSO-1)

CO3: Apply searching and sorting algorithms to solve computational problems efficiently. (PO-1,2 PSO-1)

CO4: Analyze and select appropriate data structures for given problem statements. (PO-1,2 PSO-1)

CO5: Design and implement tree-based data structures and evaluate their applications. (PO-1,2 PSO-1)

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):

● 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 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. 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	24IS66B	**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:

- 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)

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: 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; Interprocess 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

Textbook 1: Chapter 8: 8.1-8.8 Textbook 1: Chapter 9: 9.1-9.4 (9.4.1, 9.4.2)

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. (PO-1,2 PSO-1,2)
CO2: Apply appropriate CPU scheduling algorithm for the given scenarios. (PO-1,2,3 PSO-1,2)
CO3: Analyse the various techniques for process synchronization and deadlock handling. (PO-1,2,3 PSO-1,2)
CO4: Apply the various techniques for memory management. (PO-1,2,3 PSO-1,2)
CO5: Analyse the importance of File System Mounting and File Sharing. (PO-1,2 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):

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

Reference Books

2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition, 2010

3. 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.

4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008

Web links and Video Lectures (e-Resources):

1.https://archive.nptel.ac.in/courses/106/105/106105214/
2.https://archive.nptel.ac.in/courses/106/102/106102132/

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)**

Introduction to Artificial Intelligence			
Course Code	24IS66C	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	3	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on;

- Data structures
- Probability

Course Objectives:

- To understand the primitives of AI
- To familiarize Knowledge Representation Issues
- To understand fundamentals of Statistical Reasoning, Natural Language Processing.

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**
What is artificial intelligence? Problems, Problem Spaces, and search **Text Book 1: Ch 1, 2**	
Module-2	**8 Hours**
Knowledge Representation Issues, Using Predicate Logic, representing knowledge using Rules. **Text Book 1: Ch 4, 5 and 6.**	
Module-3	**8 Hours**
Symbolic Reasoning under Uncertainty, Statistical reasoning **Text Book 1: Ch 7, 8**	
Module-4	**8 Hours**
Game Playing, Natural Language Processing **Text Book 1: Ch 12 and 15**	
Module-5	**8 Hours**
Learning, Expert Systems. **Text Book 1: Ch 17 and 20**	

Course outcomes (Course Skill Set):

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

CO1: Identify the problems where the adaptation of AI has significant impact. (PO – 1,2,6 PSO – 1,2)

CO2: Analyse the different approaches of Knowledge Representation. (PO – 1,2,5 PSO – 1,3)

CO3: Explain Symbolic Reasoning under Uncertainty and Statistical reasoning. (PO – 1,4,5 PSO –1,2)

CO4: Derive the importance of different types of Learning Techniques. (PO – 1,2,4,5,11 PSO –1,2)

CO5: Explain Natural Language Processing and Expert System. (PO –1,2,5,6 PSO –2,3)

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation(CIE):

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

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

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

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

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

Semester-End Examination: 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. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbook:

1. E. Rich, K. Knight & S. B. Nair, Artificial Intelligence, 3rd Edition, McGraw Hill.,2009

Reference Books

1. Stuart Rusell, Peter Norving, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition,Prentice Hal of India, 2015
3. G. Luger, Artificial Intelligence: Structures and Strategies for complex problem Solving, 4th Edition, Pearson Education, 2002.
4. N.P. Padhy "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2015

Web links and Video Lectures(e-Resources):

1. https://nptel.ac.in/courses/106102220
2. https://nptel.ac.in/courses/106105077
3. https://archive.nptel.ac.in/courses/106/105/106105158/
4. https://archive.nptel.ac.in/courses/1

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

- Apply NLP steps for any given real time scenario. Students are expected to document different NLP steps and their output for the given scenario. Students can use python or any programming language of their choice. **(10 Marks)**
- Students are expected to identify different case studies/scenarios where expert systems can be adopted. Students need to prepare a report on any one case study. **(15 marks)**

MOBILE APPLICATION DEVELOPMENT			
Course Code	24IS66D	**CIE Marks**	50
Teaching Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
Credits	3	**Total Marks**	100
Contact Hours	40	**Exam Hours**	3
Examination type (SEE)	Theory		

Prerequisites:

The students should have knowledge on:

Java programming, OOP concepts, DBMS fundamentals, operating systems, and basic XML.

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)

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
10.

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.

Textbook: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.

Textbook: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. **Textbook:Chapters 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. **Textbook: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. **Textbook:Chapters 8, 9,10**	

Course outcome (Course Skill Set)

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

CO1: Explain Mobile Application Ecosystem like concepts, architecture, and lifecycle of mobile applications on Android(PO- 1,2,5 PSO-2,3)

CO2: Identify the key components of mobile application frameworks and development tools. (PO- 1,2,3,5 PSO-2,3)

CO3: Apply design principles to create intuitive and responsive user interfaces using appropriate UI/UX tools. (PO-1,2,3,5 PSO-1,2,3)

CO4: Develop Functional Mobile Applications -Integrate core functionalities such as layouts, event handling, navigation, and multimedia support into applications. (PO-1,2,3,4,5 PSO-1,2,3)

CO5: Implement local data storage mechanisms (SQLite, Shared Preferences) and external databases (Firebase, APIs) for mobile applications. (PO-1,2,3,4,5 PSO-1,2,3)

Assessment Details (both CIE and SEE)

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

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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 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.
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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

TEXT BOOK

1. Prasanna Kumar Dixit, "Android", Vikas Publishing House Private Ltd., Noida, 2014.

REFERENCE BOOKS

1.Reto Meier and Wrox Wiley, “Professional Android 4 Application Development”, 2012.
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:

Programming exercises, fostering the practical application of theoretical concepts. [25 marks]

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**

NATIONAL SERVICE SCHEME (NSS)			
Course Code	24NS58 / 68	**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.
- 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 for 5th and 6th semester

Sem	Topics / Activities to be Covered
5thSem for 25 Marks	Developing Sustainable Water management system for rural areas and implementation approaches. 1. 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. 2. Spreading public awareness under rural outreach programs.(minimum5 programs). 3. Social connect and responsibilities.
6th Sem for 25 Marks	5. Plantation and adoption of plants. Know your plants. 6. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).Govt. school Rejuvenation and helping them to achieve good infrastructure

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

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmersland/Villages/ roadside/ community area/ College campus etc…..	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/campus etc…..	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc…..	Group selection/pro per consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Gramapanchayat/ public associations/Government Schemes officers/campus etc…..	site selection / proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Gramapanchayat/ public associations/Government Schemes officers/campus etc…..	Group selection/pro per consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/pro per consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

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

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE – 1**
4	**Commencement of activity and its progress - PHASE – 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

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

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.
CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

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

Assessment Details for CIE (both CIE and SEE)

<table>
<tr><td>Weightage</td><td>CIE – 100%</td><td rowspan="7">• Implementation strategies of the project (NSS work).
• The last report should be signed by NSS Officer, the HOD and principal.
• At last report should be evaluated by the NSS officer of the institute.
• Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.</td></tr>
<tr><td>Presentation - 1
Selection of topic, PHASE - 1</td><td>10 Marks</td></tr>
<tr><td>Commencement of activity and its progress - PHASE - 2</td><td>10 Marks</td></tr>
<tr><td>Case study based Assessment
Individual performance</td><td>10 Marks</td></tr>
<tr><td>Sector wise study and its consolidation</td><td>10 Marks</td></tr>
<tr><td>Video based seminar for 10 minutes by each student At the end of semester with Report.</td><td>10 Marks</td></tr>
<tr><td>Total marks for the course in each semester</td><td>50 Marks</td></tr>
<tr><td colspan="3">Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.</td></tr>
<tr><td colspan="3">25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6thsem, Report and assessment copy should be made available in the department semester wise.</td></tr>
<tr><td colspan="3">Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.</td></tr>
<tr><td colspan="3">Suggested Learning Resources:

Books :
1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.</td></tr>
</table>

YOGA			
Course Code	24YO58/68	**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:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

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

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical

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

- Mental
  1. Relief of stress resulting from the control of emotions
  2. Prevention and relief from stress-related disorders
  3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
  1. Life with meaning, purpose, and direction
  2. Inner peace and tranquility
  3. Contentment

SEMESTER V

Patanjali'sAshtanga Yoga its need and importance. Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

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

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana
b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana
c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana /Rajakapotasana
d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds
Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

SEMESTER VI

Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi

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

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

d. Supine line 1. Sarvangasana
2. Setubandha Sarvangasana
3. Shavasanaa (Relaxation poisture).

Revision of Kapalabhati practice 80 strokes/min - 3 rounds
Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama 1. Bhastrika 2. Bhramari

Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati

Course outcomes (Course Skill Set):

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

CO1: Understand the meaning, aim and objectives of Yoga.

CO2: Perform Suryanamaskar and able to Teach its benefits.

CO3: Understand and teach different Asanas by name, its importance, methods and benefits.

CO4: Instruct Kapalabhati and its need and importance.

CO5: Teach different types of Pranayama by its name, precautions, procedure and uses

CO6: Coach different types of Kriyas, method to follow and usefulness.

Assessment Details for CIE (both CIE and SEE)

Students will be assessed with internal test by

a. Multiple choice questions

b. Descriptive type questions

(Two internal assessment tests with 25 marks/test)

Final test shall be conducted for whole syllabus for 50 marks.

Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

- Yogapravesha in Kannada by Ajitkumar
- Light on Yoga by BKS Iyengar
- Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
- Yoga Instructor Course hand book published by SVYASA University, Bengaluru
- Yoga for Children –step by step – by Yamini Muthanna

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

https://youtu.be/KB-TYlgd1wE

https://youtu.be/aa-TG0Wg1Ls

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – III			
Course Code	24PE58	**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:

- To develop an understanding of the importance of physical fitness, health, and overall wellness.
- To apply the basic principles of exercise, training, and nutrition for maintaining a healthy lifestyle.
- To improve physical fitness components such as strength, endurance, flexibility, agility, and coordination.
- To participate actively in a variety of physical activities, games, and athletic events.
- To develop sportsmanship, teamwork, leadership qualities, and discipline through physical education activities.
- To assess and monitor personal fitness levels using standard fitness evaluation methods.

MODULE 1	**6 Hours**

Orientation

A. Fitness
B. Food & Nutrition

MODULE 2	**6 Hours**

General Fitness & Components of Fitness

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

MODULE 3	**16 Hours**

Specific games (Any one to be selected by the student)

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

Course outcomes (Course Skill Set):

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

CO1: Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness

CO2: Familiarization of health-related Exercises and Sports for overall growth and development
CO3: Create a foundation for professionals in Physical Education and Sport
CO4: Participate in competitions at regional, state, national, and international levels.
CO5: Understand and practice specific games and athletic throwing events

Assessment Details for CIE (both CIE and SEE)

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**

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – IV			
Course Code	24PE68	**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:

- To understand the importance of Physical Education, including postural deformities and stress management in sports.
- To develop general fitness and improve key components such as strength, endurance, flexibility, and coordination.
- To acquire fundamental skills in Throw ball, Table Tennis, and athletic field events (Jumps).
- To develop proficiency in a selected specific game of the student's choice.
- To understand and perform Aerobics exercises for improving cardiovascular fitness and body coordination.
- To promote teamwork, discipline, leadership, and sportsmanship through active participation in physical activities.

MODULE 1	6 Hours

Orientation

A. Postural deformities.
B. Stress management

MODULE 2	6 Hours

General Fitness & Components of Fitness

A. Throw ball
B. Table Tennis
C. Athletics (Field Events- Jumps) – Any event as per availability of Ground.

MODULE 3	16 Hours

Specific games (Any one to be selected by the student)

1. Aerobics

Course outcomes (Course Skill Set):

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

CO1: Understand postural deformities and stress management techniques in sports and athletics

CO2:Demonstrate skills and actively participate in competitions at regional, state, national, and international levels

CO3: Understand and practice specific games and athletic jumping events with proper techniques and rules

CO4:Understand and perform basic techniques and movements of Aerobics for physical fitness and endurance.

Assessment Details for CIE (both CIE and SEE)

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**