St. John College of Engineering and Management
Autonomous Institute
(A Christian Religious Minority Institution)
Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE
DTE Code : 3218 AICTE Permanent ID : 1-4790201
NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

Autonomy Syllabus Scheme of BE / B.Tech in Artificial Intelligence and Machine Learning (Semester: IV, VI, VIII)

Academic Year 2025-26

AUTONOMY SCHEME

SJCEM R–24 (SCHEME 'B')

Sr. No.	Heading	Particulars
1.	Title of the Course	**Artificial Intelligence and Machine Learning**
2.	Eligibility for Admission	**As per the Institute Examination Ordinance**
3.	Theory Passing Marks (IAE/ESE)	**40%**
4.	Continuous Assessment (CA) / Oral / Practical	**50%**
5.	To be implemented from Academic Year	**With effect from Academic Year: 2025-2026**
6.	Total Credits	**Maximum 173**
7.	Honor/Minor Course Offered	**Data Science** (Additional Credits: 18)
8.	Eligibility Criteria for Honor/Minor	• Students with no backlog in Semester I, II, and III • The CGPI based on Semester I, II, and III of students must be 6.75 and above. • For Direct Second Year (DSE) students, no backlog in Sem III and CGPI must be 6.75 and above.

Preface

University Grant Commission vide Letter No. F. 2–10/2023 (AC–Policy) dated 19th January 2024 conferred the autonomous status to St. John College of Engineering and Management, Village Vevoor, Manor Road, Palghar (East), 401404 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations 2023. Designing the curriculum as an autonomous institution raises challenges pertaining to maintaining quality engineering education.

Systematic approach has been adapted in the design and implementation of curriculum with the intent of ensuring quality education catering to the sensitive needs of a learner, society, and industry. The curriculum is aligned with NEP and UGC guidelines as per Government of Maharashtra guidelines for autonomous institutions Government Resolution dated 4th July 2023. Based on recent recommendations of the GR, holistic curriculum for 2024-28, a "H-Tree Model" of Engineering Education is offered. A unique "H-Tree Model" of Engineering Education Curriculum is followed and curriculum is designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient), and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which a learner receives 34% teacher-led learning, 15% peer learning, 26% self-learning, and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to a leaner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science and mathematics foundation and program core, sequel of electives, multidisciplinary minor courses, humanities & management courses, and sufficient experiential learning through projects and semester-long industry/research internship along with employable skill-based courses. A learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Additional options of choosing from Honors/Double Minor/Honors with Research are also provided to a learner.

The curriculum balances contact hours and total credits of the entire program. The total credits are 173, wherein focus is not only on providing knowledge but also on building skills, attitude and self-learning. Therefore, in the present curriculum, skill-based laboratories, mini-projects, multi-disciplinary projects, and internships are made mandatory across all disciplines of engineering, which will definitely facilitate self-learning of students. The overall credits and approach of curriculum proposed in the scheme and syllabus are in line with AICTE model curriculum. SJCEM R-24B curriculum will be implemented for Artificial Intelligence and Machine Learning from the academic year 2025-26.

Mr. Ajay Sirsat
BoS Chairman

Dr. Kamal Shah
Principal

Nomenclature of the courses in the curriculum

Abbreviation	Title
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
SC	Skill Courses
LLC	Liberal Learning Courses
VSEC	Vocational and Skill Enhancement Course
VEC	Value Education Course
VSC	Vocational Skill Courses
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
CC	Co-curricular Courses

Credit Specifications:

- **Theory:** 1 credit = 15 hrs of teaching
- **Lab:** 1 Credit = 30 hrs of lab work
- **Workshop-based activities:** 1 Credit = 30 hrs of hands-on activities related to vocation/professional practice/skill based
- **Seminar/Group Discussion:** 1 Credit = 15 hrs of participation
- **Community Engagement Projects:** 1 Credit = 30 hrs of contact time along with 15 hrs of activities, preparation, report writing, independent reading, etc.

Mr. Ajay Sirsat
BoS Chairman

Dr. Kamal Shah
Principal

Bachelor of Engineering

In

Artificial Intelligence and Machine Learning

Second Year Semester – IV

SJCEM R–24 (SCHEME 'B')

Effective from Academic Year 2025-26

Program Structure for Second Year Artificial Intelligence and Machine Learning

(With Effect from 2025-26)

Semester-IV

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tu	Pr	Th	Tu	Pr	
24AIMLPCC401B	PCC	Statistics and Probability	2	1	-	2	1	-	3
24AIMLPCC402B	PCC	Analysis of Algorithm	3	-	2	3	-	1	4
24AIMLPCC403B	PCC	Computer Networks	3	-	-	3	-	-	3
24AIMLPCC404B	PCC	Operating System	3	-	2	3	-	1	4
24AIMLAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	2	-	-	1	1
24AIMLVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	2	-	-	1	1
24MDM401XB	MDM	Multidisciplinary Minor (MDM)	3	-	2	3	-	1	4
24AIMLOJT401B	OJT	Internship I	-	-	3	-	-	1	1
		Total	**14**	**1**	**13**	**14**	**1**	**6**	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/ PR	Total
24AIMLPCC401B	PCC	Statistics and Probability	20	20	60	25	-	125
24AIMLPCC402B	PCC	Analysis of Algorithm	20	20	60	25	25	150
24AIMLPCC403B	PCC	Computer Networks	20	20	60	-	-	100
24AIMLPCC404B	PCC	Operating System	20	20	60	25	25	150
24AIMLAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	-	25	-	25
24AIMLVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	-	-	25	25
24MDM401XB	MDM	Multidisciplinary Minor (MDM)	20	20	60	25	-	125
24AIMLOJT401B	OJT	Internship I	-	-	-	-	25	25
		Total	**100**	**100**	**300**	**125**	**100**	**725**

Syllabus

For

Second Year Artificial Intelligence and Machine Learning

Semester – IV

SJCEM R–24(Scheme –B)

(With Effect from 2025-2026)

Course Title: Statistics and Probability												
Semester: IV			**Term: Even**				**Course Code: 24AIMLPCC401B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
2	1	-	2	1	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work Course

Course Objectives:

The course is aimed

1. To study the basic techniques of statistics like correlation, regression and curve fitting for data analysis, Machine learning and AI.
2. To understand probability theory and random process that serve as an essential tool for applications of engineering sciences.
3. To acquaint students with the concepts of probability distributions.
4. To understand the various types of hypothesis tests and learn how to choose the most appropriate test based on the type of data and the research question.
5. Enhance problem-solving skills through the application of counting principles to solve a wide range of problems in mathematics, computer science, engineering, and other disciplines.
6. To learn about different types of graphs, Understand their properties and characteristics.

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

1. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning and AI.
2. Illustrate understanding of concepts of probability and expectation for getting the speed of the data and distribution of probabilities.
3. Apply the concepts of probability distribution to engineering problems.
4. Apply the most suitable hypothesis test for different types of data and research designs, such as t-tests, chi-square tests.
5. Apply counting principles, the pigeonhole principle, and recurrence relations effectively in various mathematical, computational, and real-world problem-solving contexts.
6. Develop proficiency in applying various graph algorithms, including traversal algorithms, shortest path algorithms.

Module	Contents	Hours	COs
I	**Statistical Techniques**	6	CO 1
	Karl Pearson's coefficient of correlation (r), Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks), Lines of regression. **Self-learning Topics:** Curve Fitting, Covariance.		
II	**Probability Theory:**	5	CO 2
	Definition and basics of probability, Discrete and continuous random variable with probability distribution and probability density function, Expectation, Variance and Standard Deviation. **Self-learning Topics:** Cumulative Distribution Function, Skewness and Kurtosis of distribution (data).		
III	**Probability Distribution**	4	CO 3
	Probability Distribution: Binomial, Poisson and Normal distribution - problems (No derivation for mean and standard deviation) **Self-learning Topics:** Bernoulli's Distribution, Uniform Distribution, Exponential Distribution		
IV	**Sampling Theory**	5	CO 4
	Introduction, Parameter and Statistics, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom. Students't-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Independence of attributes. **Self-learning Topics**: Z- Test, Goodness of fit and Yate's Correction.		
V	**Counting**	5	CO 5
	Basic Counting Principle-Sum Rule, Product Rule, Inclusion Exclusion Principle, Recurrence relations -Linear Homogeneous Recurrence Relation **Self-learning Topics:** Pigeonhole Principle, Non-Homogeneous Recurrence Relation.		
VI	**Graph Theory**	5	CO 6
	Introduction, Simple Graphs, Multigraphs, Isomorphic Graphs, Subgraphs, Complete graph, Regular, Planar graph, Walks, Trials, Path, Cycle, Connected and Disconnected Graph, Bipartite graph, Euler and Hamiltonian Graphs, Components of graph, Weighted graph, Dijkstra's Algorithm. **Self-learning Topics:** Traversal algorithms- breadth-first search, depth-first search		
	Total	**30**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

General Instructions:

- Batch wise tutorials are to be conducted. The number of students per batch should be maximum of 25 per batch.
- Students are encouraged to write at least 6 tutorials on the entire syllabus.
- Students are encouraged to write at least 4 Assignments on the entire syllabus.

The distribution of Term work Marks will be as follows:

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Tutorial): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education.
2. Narsing Deo, "Graph Theory with applications to engineering and computer science", PHI Publications.

Text Books:

1. Introductory Probability and Statistical Applications, B L Mayer, Wiley Eastern Limited, 2nd Edition.
2. Discrete and Combinatorial Mathematics-An Applied Introduction, Ralph P. Grimaldi and B V Ramana, Pearson Education, Asia, 5th Edition.

Useful Links:

1. https://www.coursera.org/specializations/discrete-mathematics
2. https:9//www.edx.org/learn/discrete-mathematics

Course Title: Analysis of Algorithms												
Semester: IV			**Term: Even**				**Course Code: 24AIMLPCC402B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination ESE:
End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To provide mathematical approaches for Analysis of Algorithms
2. To understand and solve problems using various algorithmic approaches
3. To analyze algorithms using various method
4. To solve problems using various strategies
5. To analyze strategies for solving problems not solvable in polynomial time.
6. To provide mathematical approach for Analysis of Algorithms.

Course Outcomes:

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

1. Analyze the running time and space complexity of algorithms.
2. Describe, apply and analyze the complexity of divide and conquer strategy.
3. Describe, apply and analyze the complexity of greedy strategy.
4. Describe, apply and analyze the complexity of dynamic programming strategy.
5. Explain and apply backtracking, branch and bound and string matching techniques to deal with some hard problems.
6. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete.

Module	Contents	Hours	COs
I	**Introduction to analysis of algorithm**	13	CO1
	Performance analysis, Space and Time complexity, Growth of function – Big –Oh, Omega , Theta notation, Mathematical background for algorithm analysis, Analysis of selection sort , Insertion sort. **Recurrences:** -The substitution method -Recursion tree method -Master method **Divide and Conquer Approach:** General method. Analysis of Merge sort, Analysis of Quick sort, Analysis of Binary search, Finding minimum and maximum algorithm and analysis **Self-Learning Topics**: Strassen's matrix multiplication		

II	**Dynamic Programming Approach**	7	CO2
	General Method, Multistage Graphs, Single source shortest path, All pair shortest path Assembly-line scheduling, 0/1 knapsack, Travelling salesman problem, Longest common subsequence **Self-Learning Topics:** Principles of Dynamic Programming Problems		
III	**Greedy Method Approach**	7	CO3
	General Method, Single source shortest path, Knapsack problem Job sequencing with deadlines, Minimum cost spanning trees-Kruskal's and Prim's algorithm **Self-Learning Topics:** Optimal storage on tapes		
IV	**Backtracking and Branch-and-bound:**	7	CO4
	General Method, N-queen problem, Sum of subsets, Graph coloring, 15 puzzle problem, Travelling salesman problem. **Self-Learning Topics:** Optimization in Backtracking, Constraint Propagation		
V	**String Matching Algorithms:**	6	CO5
	The naïve string matching Algorithms ,The Rabin Karp algorithm String matching with finite automata, The Knuth-Morris-Pratt algorithm **Self-Learning Topics:** Boyer-Moore Algorithm		
VI	**Non-deterministic polynomial algorithms:**	5	CO6
	Polynomial time, Polynomial time verification, NP Completeness and reducibility, NP Completeness proofs, Vertex Cover Problems , Clique Problems **Self-Learning Topics:** Importance of NP Problems		
	Total	**45**	

Sr. No.	List of Experiment	COs
1.	Selection Sort, Insertion Sort, Merge sort, Quick sort, Binary search	CO1
2.	All pair shortest path, Longest common subsequence.	CO2
3.	Fractional Knapsack problem, Job sequencing with deadlines	CO3
4.	N-queen problem and Graph coloring	CO4
5.	The naïve string matching algorithm	CO5
6.	The Rabin-Karp algorithm	CO5, CO6

Evaluation Scheme and Assessment:

A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.
3. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

Text Books:

1. T.H. Coreman , C.E. Leiserson, R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd edition , PHI publication 2005.
2. Ellis Horowitz , Sartaj Sahni , S. Rajsekaran. "Fundamentals of computer algorithms" University Press

Useful Links:

1. https://leetcode.com/explore/interview/card/leetcodes-interview-crash-course-data-structures-and-algorithms/703/arraystrings/
2. https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/
3. https://visualgo.net/en

Course Title: Computer Networks												
Semester: IV			**Term: Even**				**Course Code: 24AIMLPCC403B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	--	--	03	--	--	03	20	20	60	--	--	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims

1. To introduce concepts and fundamentals of data communication and computer networks.
2. To explore the inter-working of various layers of OSI.
3. To explore the issues and challenges of protocols design while delving into TCP/IP protocol suite.
4. To assess the strengths and weaknesses of various routing algorithms.
5. To understand various transport layer and application layer protocols.
6. To understand various application layer protocols.

Course Outcomes:

At the end of the course students will be able:

1. Demonstrate the concepts of data communication and compare ISO–OSI model with TCP/IP model.
2. Explore different concepts and design issues at physical layer.
3. Explore different design issues at data link layer.
4. Design the network using IP addressing and sub netting / super netting schemes.
5. Analyze transport layer protocols and congestion control algorithms.
6. Explore protocols at application layer

Module	Contents	Hours	COs
I	**Introduction to Networking**	5	CO 1
	1.1. Introduction to computer network, network application, network software and hardware components (interconnection networking devices), network topology, protocol hierarchies, design issues for the layers, connection-oriented and connectionless services. 1.2. Reference models: Layer details of OSI, TCP/IP models. Communication between layers. **Self-learning Topics:** Explore real-world applications of each network topology.		
II	**Physical Layer**	4	CO 2

	2.1. Introduction to communication: Electromagnetic spectrum 2.2. Guided transmission media: Twisted pair, coaxial, fiber optics. 2.3. Unguided transmission media: Radio waves, micro waves, infrared **Self-learning Topics:** Examine use cases where guided or unguided transmission media are preferred based on factors like bandwidth, distance, and cost.		
III	**Data Link Layer**	9	CO 3
	3.1. DLL design issues (services, framing, error control, flow control), error detection and correction (Hamming code, CRC, checksum), Elementary data link protocols, Stop and Wait, Sliding Window (Go Back N and Selective Repeat) 3.2. Medium access control sublayer: Channel allocation problem, multiple access protocol (ALOHA, Carrier Sense Multiple Access (CSMA/CD) & (CSMA/CA)) **Self-learning Topics:** Analyze how ALOHA, CSMA/CD, and CSMA/CA protocols are applied in wired and wireless networks to optimize medium access.		
IV	**Network Layer**	13	CO 4
	4.1. Network layer design issues, Communication primitives: unicast, multicast, broadcast. IPv4 addressing (class-full and classless), subnetting, supernetting design problems, Ipv4 protocol, network address translation (NAT), Ipv6 4.2. Routing algorithms: Shortest path (Dijkastra's), link state routing, distance vector routing 4.3. Protocols – ARP, RARP, ICMP, IGMP 4.4. Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, token & leaky bucket algorithms **Self-learning Topics:** Compare the differences between Ipv4 and Ipv6, focusing on their features and migration strategies.		
V	**Transport Layer**	7	CO 5
	5.1. Transport service: Transport service primitives, Berkeley sockets, connection management (handshake), UDP, TCP, TCP state transition, TCP timers 5.2. TCP flow control (sliding window), TCP congestion control: Slow start algorithm **Self-learning Topics:** Role of TCP timers in ensuring reliable data transmission.		
VI	**Application Layer**	7	CO 6
	6.1. DNS: Name Space, Resource Record, and Types of Name Server. HTTP, SMTP, Telnet, FTP, and DHCP **Self-learning Topics:** Learn about various types of name servers and their functions within the DNS ecosystem.		
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

Reference Books:

1. A. S. Tanenbaum, Computer Networks, 4th Edition, Pearson Education
2. B. A. Forouzan, Data Communications and Networking, 5th Edition, TMH
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, 6th Edition, Addison Wesley.

Text Books:

1. S. Keshav, An Engineering Approach to Computer Networking, Pearson
2. Natalia Olifer & Victor Olifer, Computer Networks: Principles, Technologies & Protocols for Network Design, Wiley India, 2011.
3. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Second Edition, The Morgan Kaufmann Series in Networking.

Useful Links

1. https://www.netacad.com/courses/networking/networking-essentials
2. https://www.coursera.org/learn/computer-networking
3. https://nptel.ac.in/courses/106/105/106105081
4. https://www.edx.org/course/introduction-to-networking

Course Title: Operating System												
Semester: IV			**Term: Even**				**Course Code: 24AIMLPCC404B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/ TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	02	03	-	01	04	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To understand the major components of Operating System & its functions.
2. To introduce the concept of a process and its management like transition, scheduling, etc.
3. To understand basic concepts related to Inter-process Communication (IPC) like mutual exclusion, deadlock, etc. and role of an Operating System in IPC.
4. To understand the concepts and implementation of memory management policies and virtual memory.
5. To understand functions of Operating System for storage management and device management
6. To study the need and fundamentals of special-purpose operating system with the advent of new emerging technologies.

Course Outcomes:

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

1. Understand the basic concepts related to Operating Systems.
2. Analyze and evaluate the performance of different process and disk scheduling algorithms
3. Demonstrate inter-process communication and process synchronization.
4. Analyze and evaluate various deadlock detection, avoidance and removal techniques.
5. Analyze and evaluate memory management policies in different scenarios.
6. Evaluate different file organization and access techniques

Module	Contents	Hours	COs
I	**Introduction of Operating System**	6	CO 1
	Operating System operations, Process management, Memory management, storage management, Protection and security. **System Structure:** Operating system services and interface, System calls and its types, System programs, Operating System Design and implementation, OS structure, Virtual machines, System boot. **Self-Learning Topics:** Distributed and special purpose Systems, OS debugging and generation.		
II	**Processes and Process Scheduling**	9	CO 2
	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.		

	Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.		
III	**Inter-process Communication and Deadlocks**	8	CO 3
	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.		
IV	**Memory Management and Virtual Memory**	8	CO 4
	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures –Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).		
V	**File Management and Disk Management**	7	CO 5
	File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting. **Self-Learning Topics:** Case study on UNIX and WINDOWS Operating System		
VI	**Storage Management and Secondary Storage Structure**	7	CO 6
	Storage Management **File System**: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection. Implementing file System: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management **Secondary Storage Structure:** Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management; **Self-Learning Topics :** RAID Structure		
	Total	**45**	

Tutorial No.	List of Experiments	COs
1	Study of Basic Operating System Commands (UNIX / LINUX)	CO1
2	Study and Demonstration of System Calls.	CO1
3	Simulation of CPU Scheduling Algorithms: FCFS, SJF, SRTF, RR	CO2
4	Implementation of Thread Creation and Synchronization	CO2
5	Implementation of Inter-Process Communication using Shared Memory / Pipes	CO3
6	Implementation of Producer–Consumer Problem using Semaphores	CO3
7	Simulation of Deadlock Detection and Prevention using Resource Allocation Graph	CO4
8	Implementation of Banker's Algorithm for Deadlock Avoidance	CO4
9	Simulation of Memory Management Techniques: Paging and Segmentation	CO4
10	Implementation of Page Replacement Algorithms: FIFO, LRU, Optimal	CO4
11	Simulation of File Allocation Methods: Contiguous, Linked, Indexed	CO5
12	Simulation of Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN	CO5,CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

a. N. Chauhan, Principles of Operating Systems, 1st ed., Oxford University Press, 2014.
b. A. Tanenbaum and A. Woodhull, Operating System Design and Implementation, 3rd ed Pearson.
c. R. Arpaci-Dusseau and A. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Independent Publishing Platform, 1st ed., 2018

Text Books:

1. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 8th Edition, Wiley, January 2018. 15
2. Tanenbaum, "Modern Operating System", 4th Edition, Pearson Education, 2014.
3. William Stallings, "Operating Systems: Internal and Design Principles", 8th Edition, Pearson, 2014.
4. Randal. K. Michael, "Mastering Shell Scripting", 2nd Edition, Wiley Publication, 2008.

Useful Links

1. https://www.nptel.ac.in/
2. https://swayam.gov.in/
3. https://www.youtube.com/@GateSmashers

Course Title: Employability Enhancement Program – II (Communication)												
Semester: IV			**Term: Even**				**Course Code: 24AIMLAEC401B**					
Teaching Scheme							**Evaluation Scheme:**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	2	-	-	1	1	-	-	-	25	-	25

Course Objectives:

1. To understand the importance of active listening in effective communication.
2. To cultivate effective inter-personal skills and employment skills for organizational development.

Course Outcomes: After successful completion of the course, learner will be able to …

1. Understand the importance of active listening and social etiquette for effective communication.
2. Enhance written communication, official and technical skills
3. Strengthen their personal and professional relationship in career building.
4. Ace their employability Skills through personal SWOT, Group Discussion and Resume Writing

Module	Contents	Hours	COs
I	**Listening & Social Skills** Importance of Listening, Difference between Hearing & Listening Types of Listening, Barriers of Listening, Listening (Audios/Videos) Etiquette – Social Etiquette, Dining Etiquette, Telephonic Etiquette, Email Etiquette, Reading Comprehension Skills	6	CO1
II	**Proposal & Report Writing** Letter Writing – Permission Letter, Leave Letter, Apology Letter Meetings – Notice, Agenda & Minutes, Introduction to Proposal Writing Parts of a Proposal, Types of Proposal – Research, Business Technical Paper Writing in IEEE Format Types of Paper Writing – Journal, Conference Paper, Writing a Review Paper.	8	CO2
III	**Interpersonal Skills** Presentation Skills: Power Point, Demo Presentation, Managerial Skills: Time Management, Goal Setting, Decision Making, Conflict Resolution, Team Building, Leadership, Emotional Intelligence, Critical Thinking, Assertiveness, Negotiation	8	CO3
IV	**Employability & Career Skills** SWOT Analysis: Personal & Organizational, Verbal Aptitude Test, Group Discussion Skills: Types of GD, Do's and Don'ts, Tips for cracking a GD, Resume Writing, Interview Techniques	8	CO4
	Total	**30**	

Tutorial. No.	List of Experiments / Tutorials	COs
1.	Listening Activity	CO1
2.	Comprehending Unseen Passages	CO1
3.	Writing Email Etiquette/ Do's & Don'ts of Email Writing	CO1
4.	Meeting and Documentation- Notice, Agenda & Minutes	CO2
5.	Letter Writing- Permission, Leave & Apology	CO2
6.	PPT Presentation on any Technical Topic (Group Activity)	CO2,CO3
7.	Case Study Based GD-1	CO3
8.	Case Study -2	CO3
9.	SWOT Analysis: Personal	CO4
10.	Resume Writing	CO4

Evaluation and Assessment Scheme: Continuous Assessment (CA):

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

Reference Books:

1) M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill, 2008
2) Gadyalji Vaishali K, Communication Skills, Nandu Publications, 2010
3) Rai Urmila & Rai S.M, Business Communication, Himalaya Publishing House, 2007
4) Rai Urmila & Rai S.M, Business Communication, Himalaya Publishing House, 2008
5) Raman Meenakshi & Sharma Sangeeta, Technical Communication Principles and Practice, Oxford

University Press, 2015

6) Raman Meenakshi & Singh Prakash, Business Communication, Oxford University Press, 2008
7) Luthans Fred, Organizational Behavior An Evidence-Based Approach, McGraw Hill Education Private Limited, 2013
8) Locker O Kitty & Kaczmarek Kyo Stephen, Business Communication Building Critical Skills, McGraw Hill Education Private Limited, 2007
9) Chaturvedi P D & Chaturvedi Mukesh, Business Communication Concepts, Cases and Applications, Pearson Education, 2008

Useful links:

1. https://youtu.be/TTARLuquJeE https://youtu.be/jPj0Z2lb8jg https://youtu.be/2nEvKZ4SG2c
2. PD & Social Etiquette https://youtu.be/wPorhmnMDdc https://youtu.be/n6F5icYGnSg
3. 7Cs of Effective Communication https://youtu.be/XuGCDR NIU-M
4. Letter Writing https://youtu.be/ci47OQLFjao https://youtu.be/uj6rlM62Bqk
5. Motivational Speech https://youtu.be/xrEq- 1UujOo https://youtu.be/W7BW9g v_OkU
6. Reading Comprehension https://youtu.be/3yYjYvdcCw8
7. Public Speaking Tips https://youtu.be/UNGla-- HOXQ
8. Barriers to Communication: A Case Study https://youtu.be/k9KK_0zr3LU

Course Title: Employability Enhancement Program -III (Industry Certification)												
Semester: IV			Term: Even			Course Code: 24AIMLVSEC401B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	2	-	-	1	1	-	-	-	-	25	25

Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

Course Objectives: The objectives of this course are to

1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

Course Outcomes: After completion of this course, students will be able to

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

Certification Guidelines:

The general procedure for organizing certification courses is as follows:

1. **Identification of Industry Partners**
   Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.
2. **Selection of Certification Domain**
   Students can choose two domains of interest for the certification course and express their willingness to pursue the certification.

Following combination of domains are offered in the even semesters:

Tracks	Domain 1	Domain 2
Track 1	SQL	Dotnet

	Track 2	CCNA	AI-IBM
	Track 3	Cyber Security	AI-IBM
	Track 4	Creo	Solid Works
	Track 5	Data Science	Prompt Engineering and AI
	Track 6	MERN Stack	Flutter
	Track 7	AR-VR	Game Development
	Track 8	Drone	Data Analytics
	Track 9	IELTS/GRE	Certificate in Social Science
	Track 10	Robotic	IOT
	Track 11	Blockchain Basics	Blockchain Intelligence
	Track 12	AWS	MERN Stack
	Track 13	Microsoft Tools	AI-IBM
	Track 14	Augmented Reality	Virtual Reality
	Track 15	Professional Edge Training (PET)	

3. **Allocation of Tracks**
   Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.
4. **Course Duration**
   Students have to complete the certification course, which has a minimum duration of 30 hours.
5. **Oral & Practical Exam**
   Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

Note: A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.

Course Title: Introduction to Artificial Intelligence												
Semester: IV			Term: Even				Course Code: 24MDM401XB					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR /TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To introduce the foundational concepts, history, and scope of Artificial Intelligence (AI).
2. To understand intelligent agents, their structure, and functioning in autonomous systems.
3. To study various search and optimization techniques applicable to engineering problems.
4. To explore methods of knowledge representation and reasoning for intelligent decision-making.
5. To introduce probabilistic and uncertainty-based reasoning approaches used in AI systems.
6. To familiarize students with AI-driven applications in mechanical and civil engineering, such as predictive maintenance, design optimization, and smart infrastructure.

Course Outcomes: After successful completion of the course students will be able to:

1. Explain the fundamental concepts, history, and applications of Artificial Intelligence in engineering.
2. Describe intelligent agent behavior and their role in autonomous systems.
3. Apply basic search and optimization techniques to solve engineering problems.
4. Illustrate knowledge representation and reasoning in simple real-world systems.
5. Interpret the concept of uncertainty and its handling through probabilistic reasoning.
6. Demonstrate understanding of learning methods and their applications in predictive modeling and expert systems.

Module	Contents	Hours	COs
I	**Introduction to Artificial Intelligence**	5	CO1
	Definition of AI, Evolution, and Scope. AI Perspectives: Acting/Thinking Humanly vs. Rationally. Applications in Engineering: Smart manufacturing, design optimization, structural monitoring, autonomous vehicles.AI Ethics: Responsible AI use, data privacy, human-in-loop systems. **Self-learning Topics:** Case studies on AI in construction and manufacturing automation.		

II	**Intelligent Agents**	5	CO2
	Concept of Agents and Environments. Types of Agents: Reactive, Model-based, Goal-based, and Utility-based. Engineering examples:		
	Control systems, robotics, and sensor-based monitoring systems. Environmental characteristics: Deterministic vs. stochastic, static vs. dynamic, single vs. multi-agent. **Self-learning Topics:** Simple agent simulation using Python (temperature control or traffic monitoring).		
III	**Intelligent Problem Solving and Optimization**	12	CO3
	Concept of problem formulation and state-space representation in engineering systems. Search methods: Breadth-first, Depth-first, and Heuristic-based approaches for design and planning problems. Optimization techniques: Hill Climbing, Genetic Algorithms, and Simulated Annealing for engineering optimization. **Self-learning Topics:** Application of AI techniques for optimizing structural or thermal systems		
IV	**Knowledge Representation and Expert Systems**	10	CO4
	Representation of engineering knowledge: facts, rules, and semantic networks. Logic-based reasoning: basics of Propositional and Predicate logic for rule-based systems. Expert systems: architecture, knowledge base, inference engines, and real-world applications. **Self-Learning Topic:** Case study on development of an expert system for machinery fault detection or construction safety evaluation.		
V	**Reasoning and Decision-Making under Uncertainty**	6	CO5
	Understanding uncertainty in real-world engineering data and measurements. Basics of probability: Prior, Posterior, and Conditional probability. Application of Bayes' Theorem in decision-making under uncertain conditions. Introduction to Bayesian networks for probabilistic reasoning. **Self-Learning Topic:** Develop a simple probabilistic model for weather prediction or fault estimation in a machine component.		
VI	**Machine Learning and Intelligent Engineering Systems**	7	CO6

	Introduction to Machine Learning paradigms: Supervised, Unsupervised, and Reinforcement Learning. Overview of expert systems, knowledge engineering, and their integration with AI tools. Conceptual introduction to Deep Learning and Emerging AI trends in engineering design and automation. **Self-Learning Topic:** Demonstration of AI tools using Google Colab, Teachable Machine, or any open-source platform for real-time engineering data.		
	Total	45	

Exp. No.	List of Experiments	COs
1.	Identify the Performance measure, Environment, Actuators, and Sensors (PEAS) for real-world engineering problems such as smart manufacturing system or automated construction monitoring.	CO1
2.	Describe suitable agent architecture (simple reflex, model-based, goal-based, or utility-based) for a chosen AI-enabled engineering problem.	CO1
3.	Write simple PROLOG programs for rule-based reasoning, such as identifying materials based on properties or diagnosing faults in machines.	CO1
4.	Implement Breadth-First Search (BFS) or Depth-First Search (DFS) for a simple pathfinding or layout exploration problem.	CO2
5.	Apply A Search Algorithm* for solving an 8-puzzle problem or optimal route planning in an engineering layout.	CO2, CO3
6.	Implement Hill Climbing, Simulated Annealing, or Genetic Algorithm for optimization problems like beam design, truss weight minimization, or machine scheduling.	CO3
7.	Implement Mini-Max Algorithm for a simplified decision-making scenario (e.g., resource allocation between competing agents).	CO3
8.	Demonstrate forward, backward, and resolution inference methods to prove a goal sentence from a given knowledge base.	CO4
9.	Construct a Bayesian Belief Network for an uncertain system (e.g., predicting machine failure or risk in a construction project) and perform inference using any open-source tool.	CO4
10.	Design a planning agent that generates an optimal sequence of actions for a process—such as a material handling system or construction workflow.	CO5

11.	Develop a small rule-based expert system for equipment fault diagnosis, material selection, or construction safety checks.	CO5
12.	Conduct a case study of an existing successful AI application such as: Predictive maintenance in manufacturing, AI-based structural health monitoring, or Smart city infrastructure management.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Ivan Bratko, PROLOG Programming for Artificial Intelligence, Pearson Education, Third Edition.
2. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall
3. Saroj Kaushik, Artificial Intelligence, Cengage Learning
4. Davis E. Goldberg, Genetic Algorithms: Search, Optimization and Machine Learning, Addison Wesley, N.Y., 1989.
5. Patrick Henry Winston, Artificial Intelligence‖, Addison-Wesley, Third Edition

N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press.

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach —Second Edition" Pearson Education.
2. Elaine Rich and Kevin Knight Artificial Intelligence Third Edition, Tata McGraw- Hill Education Pvt. Ltd., 2008
3. George F Luger Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2. https://nptel.ac.in/courses/106105077

Course Title: Internship-I

Semester: IV			Term: Even				Course Code: 24AIMLOJT401B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/ TU	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	3	-	-	1	1	-	-	-	-	25	25

Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass– outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

Course Objectives:

1. Integration of workshop with workplace in physical and/or hybrid model.
2. Developing research aptitude in emerging technologies
3. Enhance entrepreneurial capabilities and professional competency
4. Development of decision-making and teamwork skills
5. Cultivate a sense of Social Imagery and Citizenship Responsibility

Course Outcomes: After completion of this course, students will be able to

1. Apply practical skills effectively in physical and hybrid workplace settings.
2. Conduct and communicate research on emerging technologies.
3. Demonstrate creative problem-solving and an entrepreneurial mindset.
4. Meet industry standards with strong communication and technical skills.
5. Collaborate effectively and make informed decisions within teams.

Internship Guidelines:

- Students should apply for internships of their choice with the permission of the Institute.
- The internship duration ranges from 4 to 6 weeks and is scheduled during the summer vacation period for students
- Industry will confirm the training slots and the number of seats allocated for internships via confirmation letter/ email.
- Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Students undergo industrial training at the concerned Industry / Organization.
- Training and placement team will visit the industry and evaluate(s) the performance of students regularly and evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.
- Students will submit training report after completion of internship
- Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

- It will be evaluated on the basis of the following criteria:
  - Regularity in maintenance of the diary.
  - Project/Case study/Completion of assigned task by industry undertaken during the internship
  - Employer feedback

  Training certificate to be obtained from industry followed by the presentation in the department.

Program Structure for Third Year Artificial Intelligence and Machine Learning

(With Effect from 2025-26)

Semester-VI

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24AIMLPCC601B	PCC	Software Engineering and Project Management	3	-	2	3	-	1	4
24AIMLPCC602B	PCC	Machine Learning	3	-	2	3	-	1	4
24AIMLPEC601XB	PEC	Professional Elective III	3	-	2	3	-	1	4
24AIMLPEC602XB	PEC	Professional Elective IV	3	1	-	3	1	-	4
24OE601XB	OE	Open Elective II	3	-	-	3	-	-	3
24AIMLVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	2	-	-	1	1
24AIMLOJT601B	OJT	Internship - II	-	-	3	-	-	1	1
		Total	15	1	11	15	1	5	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24AIMLPCC601B	PCC	Software Engineering and Project Management	20	20	60	25	25	150
24AIMLPCC602B	PCC	Machine Learning	20	20	60	25	25	150
24AIMLPEC601XB	PEC	Professional Elective III	20	20	60	25	-	125
24AIMLPEC602XB	PEC	Professional Elective IV	20	20	60	25	-	125
24OE601XB	OE	Open Elective II	20	20	60	-	-	100
24AIMLVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	-	-	25	25
24AIMLOJT601B	OJT	Internship - II	-	-	-	-	25	25
		Total	**100**	**100**	**300**	**100**	**100**	**700**

Professional Elective III

Course Code	Professional Elective III
24AIMLPEC6011B	DevOps
24AIMLPEC6012B	Blockchain Technology

Professional Elective IV

Course Code	Professional Elective IV
24AIMLPEC6021B	Large Language Model (LLM)

Open Elective II Courses

Track	Course Code	Course Name
Entrepreneurship	24OE6011B	Organizational Behavior
Research Methodology	24OE6012B	Publication Guidelines and Selection of Publishers
Foreign Language	24OE6013B	Foreign Language – II (Japanese)
Business Management	24OE6014B	Basics of Finance Management

Course Title: Software Engineering and Project Management												
Semester: VI			Term: Even			Course Code: 24AIMLPCC601B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To provide the knowledge of software engineering discipline.
2. To understand Requirements and analyze it
3. To do planning and apply scheduling.
4. To apply analysis, and develop software solutions.
5. To demonstrate and evaluate real time projects with respect to software engineering principles and Apply testing and assure quality in software solution.
6. To understand need of project management and project management life cycle.

Course Outcomes: After successful completion of the course students will be able to:

1. Understand and use basic knowledge in software engineering.
2. Identify requirements, analyze and prepare models.
3. Plan, schedule and track the progress of the projects.
4. Design & develop the software solutions for the growth of society.
5. Apply testing and assure quality in software solutions.
6. To evaluate and apply advanced project management principles and techniques

Module	Contents	Hours	COs
I	**Introduction to Software Engineering**	9	CO1
	Nature of Software, Software Engineering, Software Process, Capability Maturity Model (CMM) Generic Process Model, Prescriptive Process Models: The Waterfall Model, V-model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Agile process, Agility Principles, Extreme Programming (XP), Scrum, Kanban model, Software development life cycle. **Self-Learning Topics:** Software Requirement Specification		
II	**Requirements Analysis and Cost Estimation**	7	CO2
	Software Requirements: Functional & non-functional, user-system requirement engineering process, feasibility studies, elicitation, validation & management, software prototyping, S/W documentation, Analysis and modelling Requirement Elicitation. 3Ps (people, product and process) Process and Project metrics. **Software Project Estimation:** LOC, FP, Empirical Estimation Models COCOMO II Model. **Self-Learning Topics:** Elicitation Techniques, cost estimation		

III	**Design Engineering**	8	CO3
	Design Process & quality, Design Concepts, The design Model, Pattern-Based Software Design. Architectural Design: Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, Designing class based components, conducting component- level design, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation **Self-Learning Topics:** Design Engineering, Design Process		
IV	**Software Risk, Configuration Management**	6	CO4
	Risk Identification, Risk Assessment, Risk Projection, RMMM Software Configuration management, SCM repositories, SCM process Software Quality Assurance Task and Plan, Metrics, Software Reliability, Formal Technical Review (FTR), Walkthrough. **Self-Learning Topics:** Resources allocation, Project Risk		
V	**Software Testing and Maintenance**	6	CO5
	Testing: Software Quality, Testing: Strategic Approach, Strategic Issues-Testing: Strategies for Conventional Software, Object oriented software, Web Apps Validating Testing, System Testing, Art of Debugging. Maintenance: Software Maintenance-Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering. **Self-Learning Topics:** Impact analysis, monitoring		
VI	**IT Project Management and Project Scheduling**	9	CO6
	Introduction, 4 P's, W5HH Principle, Need for Project Management, Project Life cycle and ITPM, Project Feasibility, RFP, PMBOK Knowledge areas, Business Case, Project Planning, Project Charter and Project Scope.		
	Project Scheduling: Defining a Task Set for the Software Project, Timeline charts WBS, Developing the Project Schedule, Network Diagrams (AON, AOA), CPM and PERT, Gantt Chart, Tracking the Schedule, Earned Value Analysis **Self-Learning Topics:** Project character and scope, Risk management		
	Total	45	

Exp. No.	List of Experiments	COs
1.	Study and implementation of various Software Process Models (Waterfall, V-Model, Incremental, Agile, Scrum, and Kanban) and compare their characteristics.	CO1
2.	Prepare a Software Requirement Specification (SRS) document for a sample project, including functional and non-functional requirements.	CO2
3.	Perform Feasibility Study and Cost Estimation for a software project using COCOMO II and Function Point (FP) models.	CO2
4.	Design a System Architecture Diagram and Component-Level Design using UML diagrams (DFD, Use Case, Class, Sequence, and Activity).	CO3
5.	Develop a User Interface Design for a given system using design principles and interface analysis steps.	CO3
6.	Perform Software Risk Analysis by identifying, assessing, and prioritizing risks, and prepare an RMMM (Risk Mitigation, Monitoring, and Management) plan.	CO4
7.	Demonstrate Software Configuration Management (SCM) process using version control tools like Git, including branching and merging.	CO4
8.	Conduct Software Testing using different testing levels (Unit, Integration, and System) and prepare test cases and test reports.	CO5
9.	Perform Software Maintenance and Reengineering activities on an existing codebase (e.g., restructuring or reverse engineering a module).	CO5
10.	Develop a Project Plan and Scheduling Document using tools like MS Project or Gantt Chart software; include WBS, CPM, and PERT analysis.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Software Engineering : A Precise Approach, Pankaj Jalote, Wiley India
2. Ian Sommerville, Software Engineering, 9th edition Pearson Education SBN-13: 978-0- 13-703515-1, ISBN-10: 0-13-703515-2
3. Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.

Text Books:

1. Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill
2. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India
3. John M. Nicholas, Project Management for Business and Technology, 3rd edition, Pearson Education.

Useful Links:

1. https://onlinecourses.swayam2.ac.in/cec21_cs21/preview
2. https://nptel.ac.in/courses/106101061
3. http://www.nptelvideos.com/video.php?id=911&c=9 4

Course Title: Machine Learning

Semester: VI			Term: Even			Course Code: 24AIMLPCC602B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. To introduce Machine learning concepts
2. To develop mathematical concepts required for Machine learning algorithms
3. To understand various Regression techniques
4. To understand Clustering techniques
5. To develop Neural Network based learning models

Course Outcomes: After successful completion of the course students will be able to:

1. Comprehend basics of Machine Learning.
2. Build Mathematical foundation for machine learning
3. Understand various Machine learning models
4. Select suitable Machine learning models for a given problem
5. Build Neural Network based models
6. Apply Dimensionality Reduction techniques

Module	Contents	Hours	COs
I	**Introduction to Machine Learning**	7	CO1
	1.1 Introduction to Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps of developing a Machine Learning Application.		
	1.2 Supervised and Unsupervised Learning: Concepts of Classification, Clustering and prediction, Training, Testing and validation dataset, cross validation, overfitting and underfitting of model		
	1.3 Performance Measures: Measuring Quality of model- Confusion Matrix, Accuracy, Recall, Precision, Specificity, F1 Score, RMSE **Self-Learning Topics:** Probability and Statistics, chain rule		
II	**Mathematical Foundation for ML**	6	CO2
	2.1 System of Linear equations, Norms, Inner products, Length of Vector, Distance between vectors, Orthogonal vectors		
	2.2 Symmetric Positive Definite Matrices, Determinant, Trace, Eigenvalues and vectors, Orthogonal Projections, Diagonalization, SVD and its applications **Self-Learning Topic:** LDA		
III	**Linear Models**	8	CO3
	3.1 The least-squares method, Multivariate Linear Regression, Regularized Regression, Using Least-Squares Regression for classification Label encoding.		
	3.2 Support Vector Machines **Self-Learning Topic:** Radial Basis Function Kernel		

IV	**Clustering**	5	CO4
	4.1 Hebbian Learning rule		
	4.2 Expectation - Maximization algorithm for clustering **Self-Learning Topics:** Distance Measures, Cluster Validation		
V	**Classification models**	11	CO5
	5.1 Introduction, Fundamental concept, Evolution of Neural Networks, Biological Neuron, Artificial Neural Networks, NN architecture, McCulloch-Pitts Model. Designing a simple network, Non-separable patterns, Perceptron model with Bias. Activation functions, Binary, Bipolar, continuous, Ramp. Limitations of Perceptron.		
	5.2 Perceptron Learning Rule. Delta Learning Rule (LMS-Widrow Hoff), Multi-layer perceptron network. Adjusting weights of hidden layers. Error back propagation algorithm.		
	5.3 Logistic regression **Self-Learning Topic:** Neural Networks		
VI	**Dimensionality Reduction**	8	CO6
	6.1 Curse of Dimensionality.		
	6.2 Feature Selection and Feature Extraction		
	6.3 Dimensionality Reduction Techniques, Principal Component Analysis. **Self-Learning Topics:** Independent Component Analysis (ICA)		
	Total	45	

Exp. No.	List of Experiments	COs
1.	Introduction to platforms such as Anaconda, COLAB	CO1
2.	Study of Machine Learning Libraries and tools (Python library, TensorFlow, keras,...)	CO2
	Implementation of following algorithms for a given example data set-	
3.	Linear Regression.	CO3
4.	Logistic Regression.	CO4
5.	Support Vector Machines	CO4
6.	Hebbian Learning	CO4
7.	Expectation -Maximization algorithm	CO4
8.	McCulloch Pitts Model.	CO4
9.	Single Layer Perceptron Learning algorithm	CO5
10.	Error Backpropagation Perceptron Training Algorithm	CO5
11.	Principal Component Analysis	CO6
12.	Empirical study of Curse of Dimensionality, Feature Selection.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes

(COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Tom M. Mitchell, Machine Learning, McGraw Hill
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press
3. Stephen Marsland, Machine Learning an Algorithmic Perspective, CRC Press
4. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning, Cambridge University Press
5. Peter Flach, Machine Learning, Cambridge University Press

Text Books:

1. Nathalie Japkowicz & Mohak Shah, Evaluating Learning Algorithms: A Classification Perspective, Cambridge.
2. Marc Peter Deisenroth, Aldo Faisal, Cheng Soon Ong, Mathematics for machine learning,
3. Samir Roy and Chakraborty, Introduction to soft computing, Pearson Edition
4. Ethem Alpaydın, Introduction to Machine Learning, MIT Press McGraw-Hill Higher Education
5. Peter Flach, Machine Learning, Cambridge University Press

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc23_cs18/preview
2. https://www.learndatasci.com/out/coursera-machine-learning/
3. https://www.learndatasci.com/out/google-machine-learning-crash-course/

Course Title: DevOps												
Semester: VI			**Term:** Odd				**Course Code:**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA/TW**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	---	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability
3. Implement automated system update and DevOps lifecycle
4. Promote continuous feedback and improvement

Course Outcomes:

On successful completion of this course, students will be able to:

1. Describe the fundamentals of DevOps, its culture, and its role in modern software development.
2. Use Linux commands, shell scripting, and cron jobs to automate system-level operations.
3. Apply Git for version control and collaborate using remote repositories.
4. Design and implement basic CI/CD pipelines using popular tools.
5. Use containers for packaging and deploying applications.
6. Demonstrate deployment, monitoring, and basic troubleshooting in a DevOps environment.

Module	Contents	Hours	COs
I	**Introduction to DevOps:** Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples. **Self-Learning** :- Tools overview: Git, Jenkins, Docker, Kubernetes, etc	8	CO1
II	**Software development models and DevOps**: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing. DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience. **Self Learning :-** Navigating the file system, Creating, copying, and removing files/directories, Managing permissions on files and directories	8	CO2

III	**Introduction to project management:** The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.	8	CO3
IV	**Testing Tools and automation:** Various types of testing, Automation of testing Pros and cons, Selenium Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development	8	CO4
V	**Integrating the system:** Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.	7	CO5
VI	**Deployment of the systems:** Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, Salt Stack and Docker	6	CO6
Total		45	

Exp. No.	**List of Experiments**	**COs**
1	Creating Scrum board, Kanban board, user stories, sprint planning using Trello/Jira.	CO1
2	Designing CI/CD pipeline stages and identifying bottlenecks using Draw.io / Lucidchart.	CO2
3	Preparing and demonstrating the complete DevOps lifecycle: Plan → Code → Build → Test → Deploy.	CO2
4	Creating automated test execution pipeline using GitHub Actions / any online CI tool.	CO3
5	Diagramming and comparing monolithic vs microservices, identifying advantages and use-cases.	CO3
6	Performing schema migration using tools like Flyway/Liquibase (or simulated environment).	CO4
7	Executing Git commands: clone, add, commit, push, pull, branch, merge.	CO4

8	Creating feature branch, committing code, raising PR, adding reviewers, merging changes.	CO5
9	Creating a Jenkins Freestyle/ Pipeline job, configuring build steps, running the job.	CO5
10	Writing a Selenium script to open a webpage, validate title, and capture output.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes

(COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam
Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. The DevOps Handbook – Gene Kim, Jez Humble, Patrick Debois, John Willis
2.Accelerate: The Science of Lean Software and DevOps – Nicole Forsgren, Jez Humble, Gene Kim
3. Continuous Delivery – Jez Humble, David Farley
4. Learning Docker – Pethuru Raj, Jeeva S. Chelladhurai
5. Kubernetes in Action – Marko Lukša

Text Books:

1.DevOps: A Software Architect's Perspective – Len Bass, Ingo Weber
2. Effective DevOps – Jennifer Davis, Katherine Daniels
3. Beginning DevOps with Docker – Joseph Muli
4. Ansible for DevOps – Jeff Geerling
5. Jenkins: The Definitive Guide – John Ferguson Smart

Useful Links

1. http://www.cse.iitm.ac.in/~miteshk/CS6910.html
2. https://nptel.ac.in/courses/106/106/106106184/
3. https://www.deeplearningbook.org/

Course Title: Blockchain Technologies												
Semester: VI			Term: Even			Course Code: 24AIMLPEC6012B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To get acquainted with the concept of Distributed ledger system and Blockchain.
2. To learn the concepts of consensus and mining in Blockchain through the Bitcoin network.
3. To understand Ethereum and develop-deploy smart contracts using different tools and frameworks
4. To understand permissioned Blockchain and explore Hyperledger Fabric.
5. To understand different types of crypto assets.
6. To explore the integration of Blockchain with emerging technologies such as AI, IoT, and Cyber Security.

Course Outcomes: Upon successful completion of the course, students will be able to:

1. Describe the basic concept of Blockchain and Distributed Ledger Technology.
2. Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions
3. Implement smart contracts in Ethereum using different development frameworks.
4. Develop applications in permissioned Hyperledger Fabric network.
5. Interpret different Crypto assets and Crypto currencies
6. Analyze the use of Blockchain with AI, IoT and Cyber Security using case studies.

Module	Content	Hours	COs
I	**Introduction to Blockchain & Security Foundations** : **Distributed Ledger Technologies & Security Concepts:** Evolution of Blockchain, Need for Blockchain in secure networks, CIA Triad (Confidentiality, Integrity, Availability) and how blockchain supports **integrity** and **availability,** Fundamental blockchain components and how they enhance **tamper resistance.** **Self Learning:-** Types of blockchains from a security perspective: Public, Private, Consortium.	5	CO1
II	**Block Structure & Cryptographic Security :** Block structure and metadata, Block header hash, block height and their role in **data immutability,** The Genesis block and establishing a **trusted root,** Linking of blocks using	5	

	hashes to create **cryptographic audit trails.** **Self Learning:-** Merkle Trees for efficient and secure data validation		
II	**Consensus Protocols, Network Security**: **Consensus & Fault Tolerance**: Byzantine Generals Problem as a network security challenge, Consensus algorithms as security mechanisms to achieve agreement in trustless networks, PoW, PoS, PoET, PoA, LPoS, pBFT, Proof-of-Burn, Mining difficulty, attacker cost models, Sybil attack resistance. **Self Learning:-** Mining pools and potential security implications.	6	CO2
III	**Bitcoin Architecture & Secure Transactions**: What is Bitcoin (from a cryptographic money perspective), History and trust model of Bitcoin, Keys, addresses, nodes → cryptographic identity management, Bitcoin mining, hashcash, and network security, Block propagation, relays, and secure peer-to-peer networking, Bitcoin scripts and validation → secure transaction logic. **Self Learning:-** Security risks: double spending, 51% attacks, network partition attacks	8	
IV	**Ethereum, Smart Contracts, and Secure Decentralized Applications**: **Ethereum Architecture & Network Security:** History, components, and security goals, Ethereum Virtual Machine (EVM) and security sandboxes, Miners, mining nodes, and consensus impact on security, Ether, Gas → economic security models, Architecture and secure transaction lifecycle, Accounts, Merkle Patricia Trees for secure state management, IPFS, Swarm, Whisper → secure decentralized file and communication systems, Using Ganache for secure testing environments, Ethereum block structure and on-chain metadata, Bitcoin vs Ethereum: security model comparison. **Smart Contracts:** history, characteristics, working of smart contracts, types, Oracles, Structure & Limitations. **Self Learning:- Solidity programming:** set-up tools and installation, Basics, functions, Visibility and Activity Qualifiers, Ethereum networks, solidity compiler, solidity files and structure of contracts, data types, storages, array, functions, Developing and executing smart contracts in Ethereum.	12	CO3
V	**Private and Consortium blockchains:** Introduction to Private Blockchain**:** Key characteristics, need, Examples of Private and Consortium blockchains, Smart contracts in private blockchain. Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric, Comparison between Hyperledger Fabric & Other Technologies. **Self Learning :-** Hyperledger Platform, Paxos and Raft consensus, Ripple and Corda blockchains, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT.	5	

VI	**Cryptocurrencies and digital tokens :-** Cryptocurrency basics, types, usage. ICO: basics and related terms, launching an ICO, pros and cons, evolution and platforms, STO. Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets. Transactions in Blockchain, UTXO and double spending problem. **Self-Learning:-** Applications of Blockchain: Various domains including Education, Energy, Healthcare, real-estate, logistics, supply chain.	4	CO4
Total		**45**	

Sr. No.	List of Experiment	COs
1.	Create a 5-Block Chain with Merkle Tree	CO 1
2.	Simulate PoW Mining with Adjustable Difficulty	CO 1
3.	Generate Bitcoin Address from Private Key	CO 2
4.	Send ETH + Custom Data on Sepolia Testnet	CO 2
5.	Deploy "Counter" Contract with Events	CO 3
6.	Create ERC20 Token with Mint/Burn	CO 3
7.	Build a Todo List DApp (Add, Toggle, Delete)	CO 4
8.	Run Ganache + Call Contract via Web3.py	CO 4
9.	Mint 3 NFTs with Different Metadata on IPFS	CO 5
10.	Supply Chain Tracker with 4 States	CO 5
11.	Swap Tokens on Uniswap Testnet (Goerli)	CO 6
12.	Run Hyperledger Fabric First Network with Chaincode	CO 6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment

2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Mastering Bitcoin, programming the open Blockchain‖, 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386.
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3. Blockchain Technology: Concepts and Applications, Kumar Saurabh and Ashutosh Saxena, Wiley Publication.

Text Books:

1. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyen, Universities press.
2. Solidity Programming Essentials: A beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication
3. Hyperledger Fabric In-Depth: Learn, Build and Deploy Blockchain Applications Using Hyperledger Fabric, Ashwani Kumar, BPB publications
4. cryptoassets: The Innovative Investor‘s Guide to Bitcoin and Beyond, Chris Burniske & Jack Tatar
5. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O‘reilly.

Useful Links:

1. https://www.ibm.com/think/topics/blockchain
2. https://onlinecourses.nptel.ac.in/noc22_cs44/preview
3. https://nptel.ac.in/courses/106105235
4. https://nptel.ac.in/courses/106104220

Course Title: Large Language Model (LLM)												
Semester: VI			**Term:** Even				**Course Code: 24AIMLPEC6021B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	1	-	3	1	-	4	20	20	60	25	--	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country
3. To analyze sustainable practices in in ancient India
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance

Course Outcomes:

On completion of the course, the learner will be able to:
1.Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.
3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5.Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern society

Module	**Detailed Contents**	**Hrs**	**CO**
I	**Introduction to Generative AI &Transformer Architecture** Domains of Generative AI, Evolution of Architectures, Understanding tl Transformer Model, Attention Mechanisms, Tokenization & Decodin Reinforcement Learning for Alignment, Limitations & Challenges Generative AI.	8	CO1
II	**Language Models - Unveiling the Power of Words** Introduction to Language Models, BERT (Bidirectional Encoder Representations from Transformers),Other Notable LLM Architectures, Mixture of Experts (MoE) Models, Benchmarks for Evaluating LLMs	10	CO2
III	**Prompt Engineering** Introduction to Prompts, Fundamentals of Prompt Engineering, Prompting	8	CO3

	Techniques, Advanced Prompting Strategies, Tree of Thought Prompting, LLM-based Agents & Large Action Models (LAMs)		
IV	**Retrieval Augmentation & Generation (RAG) and Fine-tuning for LLMs-** Introduction to Retrieval Augmentation & Vectors, Vector Storage & Indexing, Lang Chain Integration for Retrieval, Fine-tuning Fundamentals, Fine-tuning Techniques, Applications of Fine-tuned LLMs	10	CO4
V	**Evaluating LLMs -** Introduction to LLM Evaluation, Common Metrics for LLM Performance Challenges of Bias and Fairness in LLMs, Techniques for Mitigating Bias Evaluation in RAG Models, Evaluation in RAG Models, Using RAGAS (Retrieval-Augmented Generation Assessment) for evaluation	4	CO5
VI	**Multimodal Architectures - Beyond Text** Introduction to Multimodal LLMs, Architectures for Multimodal LLMs, Applications of Multimodal LLMs, Image captioning (describing images in words),Multi-task LLMs, Time Series Analysis with LLMs.	5	CO6
Total		45	

Sr. No.	**EXPERIMENTS**	**COs**
1.	Build your own simple LLM Application using Lang Chain.	CO1
2	Text summarization using a pre-trained LLM	CO1
3.	Q&A Bot with a Wikipedia Search Tool	CO2
4.	Open-sourced LLMs for function calling.	CO2
5.	Build a chatbot using LangChain	CO3
6.	Image Captioning using Pretrained BLIP Model"	CO3
7.	Understanding various retrievers in Langchain	CO4
8.	Question Answering Application using LLM based agents	CO4
9.	Query PDF using Lang Chain and Pine cone.	CO5
10.	Mini project	CO5.6
11.	Query a Local PDF with LangChain Loader	CO6
12.	LLM Workflow Automation (API integration)	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Text Books

1. **Ben Auffarth** – Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT, and Other LLMs (Packt Publishing, 2023)
2. **Valentina Alto** – Modern Generative AI with ChatGPT and OpenAI Models (Packt Publishing, 2023)
3. **Jay Alammar, Maarten Grootendorst** – Hands-On Large Language Models (O'Reilly, 2023)
4. **Thushan Ganegedara** – Natural Language Processing with TensorFlow (Packt Publishing, 2nd Edition, 2022)

Reference Books

1. **David Foster** – *Generative Deep Learning* (O'Reilly, 2020)
2. **Lewis Tunstall, Leandro von Werra, Thomas Wolf** – *Natural Language Processing with Transformers* (O'Reilly, 2022)
3. **Sebastian Raschka** – *Build a Large Language Model (From Scratch)* (Manning, ISBN 9781633437166)

Web Resources Blogs and Websites:

1. Mixture of Experts: Mixture of Experts Explained (huggingface.co)

2. PEFT:Efficient Model Fine-Tuning for LLMs: Understanding PEFT by Implementation | by

Shivansh Kaushik | Medium

3. Various benchmarks to evaluate LLMs: LLM Benchmarks: Understanding Language Model Performance (humanloop.com)

4. Types of attention mechanism: Understanding and Coding the Self-Attention Mechanism of

Course Title: Organizational Behaviour												
Semester: VI			**Term:** Even				**Course Code: 24OE6011B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce the fundamentals and scope of Organisational Behaviour and its importance in business.
2. To analyse individual differences and behavioural aspects such as motivation, personality, and perception.
3. To evaluate the influence of group behaviour, leadership, conflict, and stress on organisational effectiveness.
4. To apply concepts of organisational culture, change, and development for effective management.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Explain the foundations, concepts, and models of organisational behaviour and their relevance to management practice.
2. Apply theories of motivation, learning, perception, and personality to analyse individual behaviour at the workplace.
3. Analyse group dynamics, teamwork, and decision-making processes to improve group effectiveness.
4. Apply leadership theories and conflict management techniques to real organisational situations.
5. Evaluate causes of stress, coping strategies, and approaches to organisational change and development.
6. Interpret the role of organisational culture and climate in shaping employee behaviour and organisational performance.

Module	Content	Hours	COs
1	**Module 1: Introduction to OB** Nature, scope, and importance of OB, Contributing disciplines (Psychology, Sociology, Anthropology, Political Science), Models of OB (Autocratic, Custodial, Supportive, Collegial, System), Hawthorne studies and key behavioural foundations, Challenges and opportunities in OB	8	1
2	**Module 2: Individual Behaviour in Organizations** Personality: determinants, traits, and types, Perception: process, factors, and errors, Attitudes, values, and beliefs, Motivation: content and process theories (Maslow, Herzberg, McGregor), Learning: classical, operant, social learning theories, Motivation- performance link, incentives (financial & non-financial)	8	2
3	**Module 3: Group Behaviour & Teamwork** Groups vs. Teams: features and importance, Stages of group development (Tuckman), Group norms, cohesiveness, and effectiveness, Team roles, building, and decision-making, Inter- group relations and conflicts	7	3
4	**Module 4: Leadership & Conflict Management** Leadership: meaning, traits, and characteristics, Theories of leadership: Trait, Behavioural, Contingency (Fiedler, Path-Goal), Leadership styles and modern perspectives, Conflict: nature, levels, and types, Conflict management approaches and negotiation	7	4
5	**Module 5: Stress & Organisational Change** Stress: meaning, causes, and consequences, Stress management: individual & organisational strategies, Organisational change: nature, resistance, and strategies, Planned change and steps, Organisational Development: objectives, interventions	8	5
6	**Module 6: Organisational Culture & Climate** Concept, importance, and elements of culture, Managing organisational culture and sub-cultures, Organisational climate: factors and measurement, Relationship of culture & climate with effectiveness, Contemporary issues: ethics, work-life balance, globalisation	7	6
Total		**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three

Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Luthans, F. (2017). *Organisational Behavior-An evidence based approach.* (12th ed.). McGraw-Hill Education.
2. Pareek, U. (2014). *Understanding Organisational Behavior*. Delhi, India: Oxford University Press.
3. Robbins, S. T., & Judge, T. A. (2019). *Essentials of Organizational Behaviour*. (14th ed.). London, United Kingdom: Pearson.
4. Singh, A. K., & Singh, B. P. (2007). *Organisational Behavior*. Delhi, India: Excel Books Pvt. Ltd.
5. Singh, K. (2015). *Organisational Behavior: Texts & Cases.* (3rd ed.). India: Pearson. **es**

Text Books:

1. Greenberg, J. (2015). *Behavior in Organizations.* (10th ed.). Delhi, India: Pearson Education India.
2. Hersey, P. K., Blanchard, D., & Johnson, D. (2013). *Management of Organizational Behavior*. Pearson.

Useful Links:

5. https://onlinecourses.nptel.ac.in/noc25_mg80/preview
6. https://onlinecourses.nptel.ac.in/noc24_mg45/preview
7. https://www.coursera.org/learn/managing-people-iese
8. https://www.udemy.com/topic/organizational-behavior/?srsltid=AfmBOoqnqkmy7IS_9U0iGMzGxhEhHsciebpf_d_eb2xwkQwkRZ_pXRrE

Course Title: Publication Guidelines and Selection of Publishers												
Semester: VI			**Term:** Even				**Course Code: 24OE6012B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Familiarize students with the fundamentals of research publication ethics, processes, and standards.
2. Enable learners to identify suitable journals, conferences, and publishers for their research work.
3. Develop understanding of indexing, impact metrics, and quality parameters of scientific journals.
4. Guide students in preparing high-quality manuscripts and avoiding unethical publication practices.

Course Outcomes: On successful completion of the course, students will be able to…

1. Explain the publication process, ethics, and structure of scholarly articles.
2. Identify appropriate journals and publishers based on indexing, scope, and impact factors.
3. Prepare a research manuscript adhering to standard publication guidelines.
4. Analyze different types of open access and subscription-based publishing models.
5. Evaluate journal quality using metrics such as Scopus, Web of Science, SJR, and CiteScore.
6. Demonstrate awareness of predatory journals, plagiarism, and intellectual property considerations in publishing.

Module	Content	Hours	COs
1	Introduction to Research and Publication Ethics Definition and importance of research publications Types of research outputs – journal papers, conference papers, patents, books, chapters Ethics in research and publication – plagiarism, fabrication, falsification, authorship ethics Role of UGC-CARE, COPE, and other ethical bodies **Self-Learning Topics:** Case studies of publication misconduct Tools for plagiarism checking (Turnitin, iThenticate)	8	1
2	**Structure and Components of a Research Paper** IMRaD format (Introduction, Methods, Results, and Discussion) Title, abstract, keywords, and references Writing style, clarity, and technical presentation Common errors in manuscript writing **Self-Learning Topics:** Review of high-quality papers in one's own domain, Practice: Drafting an abstract and title for a sample research topic	8	2
3	**Journal Selection and Publisher Identification** Understanding journal scope and aims Parameters for journal selection: indexing, impact factor, acceptance rate, review process Publisher types: academic, society, and commercial publishers Overview of major publishers (Elsevier, Springer, IEEE, Taylor & Francis, Wiley, etc.) **Self-Learning Topics:** Identifying suitable journals using Scopus, Web of Science, or DOAJ Exploring publisher portals for submission guidelines	7	3
4	**Indexing, Impact Metrics, and Quality Evaluation** Indexing databases: Scopus, Web of Science, PubMed, Google Scholar Impact metrics: Impact Factor, SJR, CiteScore, h-index Understanding quartiles (Q1–Q4) Identifying predatory journals and fake publishers **Self-Learning Topics:** Checking authenticity of journals via Scopus or UGC-CARE List Comparing journals using SJR or CiteScore	7	4

5	**Open Access and Copyright in Scholarly Publishing** Open Access models: Gold, Green, Hybrid Publication charges (APC), institutional repositories Copyright, licensing (Creative Commons), and author rights Retraction and corrections in publications **Self-Learning Topics:** Study of Creative Commons licenses Explore open access repositories (arXiv, SSRN, ResearchGate)	8	5
6	**Manuscript Submission, Review, and Post-Publication Process** Journal submission systems (Editorial Manager, ScholarOne, etc.) Peer review process: types, timelines, reviewer feedback Revision and resubmission process Promoting research visibility: ORCID, ResearchGate, Google Scholar, LinkedIn Citation management tools (Mendeley, EndNote, Zotero) **Self-Learning Topics:** Creating and maintaining a professional research profile (ORCID, Google Scholar) Simulated peer-review exercise	7	6
Total		**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. **Santosh** Kumar Yadav, *Research and Publication Ethics,* Springer Nature Year: 2023
2. Maria Bonn, Josh Bolick & Will Cross (eds.), *Scholarly Communication Librarianship and Open Knowledge,* Association of College & Research Libraries (ALA) / ALA Editions
Year: 2023
3. Patrick Gamsby, *The Discourse of Scholarly Communication,* Lexington Books Year: 2023

Text Books:

1. Sheeba P. S., *Research and Publication Ethics: A Comprehensive Guide to Ethical Research Practices,* Notion Press, Year: 2024
2. (Alternate Textbook), *Research Publication and Ethics: A Comprehensive Guide* Publisher / Author details: (Amazon listing), Year: 2024
3. Upendra Pratap Singh, Sakshi Ahlawat, Sushma Sharma — *Research & Publication Ethics,* Sultan Chand & Sons, 2025

Useful Links:
https://onlinecourses.swayam2.ac.in/nou25_ge91/preview
https://onlinecourses.swayam2.ac.in/cec24_ge17/preview

Course Title:Foreign Language - II (Japanese)												
Semester: VI			**Term: Even**				**Course Code:** 24OE6013B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-		3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Objectives:

1. To give basic introduction of Japanese language
2. How to introduce yourself in Japanese
3. Perceive greetings
4. Learn Hiragana and Katakana scripts
5. Count 0 to 99999
6. Basic vocabulary
7. Basic grammar
8. Basic sentence formatting

Course Outcomes:

After successful completion of the course students will be able to:

1. Understand basic Japanese language rules
2. Self-introduction
3. Daily use greetings as per occasions
4. Read and write Hiragana and Katakana scripts
5. Counting till 99999.
6. To gain understanding of basic vocabulary, grammar, and sentence formatting

Module	Contents	Hours	COs
I	**Basic Introduction to Japanese language, Greetings, Scripts** Self-introduction /Basic Japanese language rules / Daily use greetings /Countries, nationality, languages / Hiragana and Katakana scripts / Revision Self Learning: Practice, revision by students and homework.	8	CO1
II	**Script, Basic vocabulary, Basic grammar pattern, Particles, Simple sentence formation** Katakana script continues / 20 basic simple vocabulary / Basic grammar patterns / Particles wa, ka, mo, no / Simple sentence formation using basic grammar pattern Present positive / Present negative / Past positive / Past negative tenses (Desu / Dewa arimasen / Deshita / Dewa arimasen Deshita) / Revision Self Learning: Practice, revision by students and homework.	7	CO2
III	**Numbers, Months, Days of the week, Lesson 1** 1-100 numbers / 12 months /07 days / Lesson 1 vocabulary, grammar, lesson 1 reading and exercises / Revision Self Learning: Practice, revision by students and homework.	7	CO3
IV	**Grammer and Reading** Vocabulary, grammar, lesson 2 reading and exercises Self Learning: Practice, revision by students and homework.	7	CO4
V	**Numbers Part1** 101-9999 numbers / Lesson 3 vocabulary, Kanjis, grammar, lesson reading and exercises Self Learning: Practice, revision by students and homework.	8	CO5
VI	**Numbers Part 2** 10000-99999 numbers / Lesson 4 vocabulary, Kanjis, grammar, lesson reading and exercises / Revision Self Learning: Practice, revision by students and homework.	6	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Text Books(T):

1.Nihongo Shoho Part 1

Online References:

Sr. No.	Link Address
1	https://youtu.be/eSJbukpiNIk?si=QfRa3ZJsH50e2h1A
2	https://youtu.be/98rDSRw7sv0?feature=shared
3	https://youtu.be/R5Sv7EqeZwQ?si=AFFpYhDl-J5yvoCE

Course Title: Basics of Finance Management												
Semester: VI			**Term: Even**			**Course Code:** 24OE6014B						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination ESE:
End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand financial and cost accounting principles, corporate finance concepts and financial statements. and the preparation and interpretation of financial statements
2. To understand cash flow and analysis of financial statements.
3. To understand and define break even analysis and budgeting.
4. To describe capital structure, risk-return analysis, time value of money, valuation methods for bonds and stocks, compute WCC, evaluate capital investments and Analyse dividend policies.

Course Outcomes:

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

1. Explain the concepts related to financial and cost accounting, corporate finance and financial statements.
2. Prepare, interpret and Analyse financial and cash flow statements.
3. Apply cost accounting techniques to prepare cost sheets and optimize resource allocation.
4. Explain cost accounting and Allocation and Apportionment of Overheads, prepare a
5. Analyse financial decisions, evaluate risks, and apply valuation techniques for bonds and stocks.
6. Compute WACC, evaluate capital investments, and Analyse dividend policies in real-world scenarios.

Module	Contents	Hours	COs
I	**Introduction to Financial and Cost Accounting:**	7	CO1
	Distinctions Between Financial and Cost/Management Accounting, Processes of Recording Business Transactions, Users of Financial and Cost/Management Accounting Information, Decision-Making Through Cost/Management Accounting **Introduction to Corporate Finance:** Meaning and Functions of Corporate Finance, Fundamentals of the Time Value of Money **Financial Statements Basics:** Recording, Classifying, and Summarizing Transactions, Income Statement and Balance Sheet Concepts, Dual Effect Concept (Double-Entry Bookkeeping), Accrual and Entity Concepts in Accounting		
II	**Preparation of Financial Statements:**	9	CO2

	Classification of Items (Assets, Liabilities, Equity, Revenue, Expenses), Applications of Double-Entry System, Accruals, Depreciation, and Adjustments (Prepaid Expenses, Accrued		

	Interest) **Cash Flow Statements:** Direct and Indirect Methods, Cash Flow from Operating, Investing, and Financing Activities, Analysis of Cash Flow with Income Statement and Balance Sheet **Financial Statement Analysis: Ratio Analysis:** Liquidity, Profitability, Efficiency, Dividend Ratios, Working Capital Management		
III	**Introduction to Cost Accounting:**	9	CO3
	Cost, Costing, and Cost Accounting: Definitions and Purposes, Classification of Costs: Fixed, Variable, Direct, Indirect, Opportunity Costs **Preparation of Cost Sheets:** Prime Cost, Conversion Cost, and Total Cost, Classification of Manufacturing and Non- Manufacturing Costs **Allocation and Apportionment of Overheads:** Primary and Secondary Distribution, Activity-Based Costing (ABC): Concepts, Drivers, and Applications		
IV	**Break-Even Analysis:**	7	CO4
	Contribution Analysis, Cost-Volume-Profit Analysis, Margin of Safety and Operating Leverage **Decision-Making Examples:** Keep or Drop Products, Make or Buy Decisions, Incremental Costs and Relevant Costs **Budgeting:** Types of Budgets: Self-Imposed, Master, and Cash Budgets, Flexible Budget and Variance Analysis		
V	**Capital Structure and Valuation Basics:**	6	CO5
	Structure of Finance Function, Capital Structure Decisions, Risk and Return Concepts: Beta, Sharpe Ratio, Jensen's Alpha **Time Value of Money and Valuation:** Present Value and Future Value (Single and Multi-Period Cases), Perpetuity, Growing Perpetuity, and Annuity **Bond and Stock Valuation:** Bond Pricing, Yield to Maturity, and Zero-Coupon Bonds, Stock Valuation: Zero Growth, Constant Growth, Differential Growth		
VI	**Cost of Capital and WACC:**	7	CO6
	Capital Asset Pricing Model (CAPM) and Dividend Discount Model (DDM), Cost of Debt, Equity, and Preferred Stock, Weighted Average Cost of Capital (WACC) **Capital Investment Decisions:** Techniques: NPV, IRR, Payback Period, Comparisons Between Techniques **Dividend and Payout Policies:** Types of Payout: Regular Dividend, Stock Dividend, Stock Splits, Dividend Signaling and Real-World Implications		
	Total	**45**	

Self-Learning Topics : Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges, Continuous Compounding and Continuous Discounting., Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis, Management of Receivables; and Management of Cash and Marketable Securities, Concept of Optimal Capital Structure, Walter's Approach, and Modigliani Miller Approach

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Accounting: Text and Cases; Robert N Anthony, David F Hawkins and Kenneth A Merchant, McGraw Hill Education.
2. Cost Accounting; Horngren, Foster & Dattar; PHI Publication
3. Corporate Finance by Ross, Westerfield, Jaffe, Jordan and Kakani, McGraw Hill Education.

Online Reference:

1. https://onlinecourses.nptel.ac.in/noc25_ec02/preview

Course Title: Employability Enhancement Program III (Industry Certification)												
Semester: VI			Term: Even			Course Code: 24AIMLVSE602						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	2	-	-	1	1	-	-	-	-	25	25

Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

Course Objectives: The objectives of this course are to

1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

Course Outcomes: After completion of this course, students will be able to

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

Certification Guidelines:

The general procedure for organizing certification courses is as follows:

1. **Identification of Industry Partners**
   Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.
2. **Selection of Certification Domain**
   Students can choose two domains of their interest for the certification course and express their willingness to pursue the certification.
   Following combination of domains are offered in the even semesters:

Tracks	Domain 1	Domain 2
Track 1	SQL	Dotnet

Track 2	CCNA	AI-IBM
Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works
Track 5	Data Science	Prompt Engineering and AI
Track 6	MERN Stack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IOT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MERN Stack
Track 13	Microsoft Tools	AI-IBM
Track 14	Augmented Reality	Virtual Reality
Track 15	Professional Edge Training (PET)	

3. **Allocation of Tracks**

   Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.

4. **Course Duration**

   Students have to complete the certification course, which has a minimum duration of 30 hours.

5. **Oral & Practical Exam**

   Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

Note: A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.

Course Title: Internship II												
Semester: VI			Term: Even			Course Code: 24AIMLOJT601						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	3	-	-	1	1	-	-	-	-	25	25

Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass–outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

Course Objectives:

1. Integration of workshop with workplace in physical and/or hybrid model.
2. Developing research aptitude in emerging technologies
3. Enhance entrepreneurial capabilities and professional competency
4. Development of decision-making and teamwork skills
5. Cultivate a sense of Social Imagery and Citizenship Responsibility

Course Outcomes: After completion of this course, students will be able to

6. Apply practical skills effectively in physical and hybrid workplace settings.
7. Conduct and communicate research on emerging technologies.
8. Demonstrate creative problem-solving and an entrepreneurial mindset.
9. Meet industry standards with strong communication and technical skills.
10. Collaborate effectively and make informed decisions within teams.

Internship Guidelines:

- Students should apply for internships of their choice with the permission of the Institute.
- The internship duration ranges from 4 to 6 weeks and is scheduled during the summer vacation period for students
- Industry will confirm the training slots and the number of seats allocated for internships via confirmation letter/ email.
- Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Students undergo industrial training at the concerned Industry / Organization.
- Training and placement team will visit the industry and evaluate(s) the performance of students regularly and evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.
- Students will submit training report after completion of internship.
- Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.
- It will be evaluated on the basis of the following criteria:
  - Regularity in maintenance of the diary.
  - Project/Case study/Completion of assigned task by industry undertaken during the internship
  - Employer feedback
- Training certificate to be obtained from industry followed by the presentation in the department.

Department of Artificial Intelligence and Machine Learning

Fourth Year

Semester – VIII

SCHEME: SJCEM R–24 (Scheme – 'B')

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24AIMLPCC801B	PCC	Advanced Artificial Intelligence	3	-	2	3	-	1	4
24AIMLPEC801XB	PEC	Department Level Optional Course 5	3	-	2	3	-	1	4
24AIMLPEC802XB	PEC	Department Level Optional Course 6	3	-	2	3	-	1	4
24ILOC802XB	OE	Institute Level Optional Course 2	3	-	-	3	-	-	3
24AIMLVSE801B	VSEC	Industry Certification	-	-	2	-	-	1	1
24AIMLPRJ801B	PRJ	Major Project 2	-	-	10	-	-	5	5
		Total	**12**	**0**	**16**	**12**	**0**	**9**	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24AIMLPCC801B	PCC	Advanced Artificial Intelligence	20	20	60	25	25	150
24AIMLPEC801XB	PEC	Department Level Optional Course 5	20	20	60	25	25	150
24AIMLPEC802XB	PEC	Department Level Optional Course 6	20	20	60	25	25	150
24ILOC802XB	OE	Institute Level Optional Course 2	20	20	60	-	-	100
24AIMLVSE801B	VSEC	Industry Certification	-	-		-	25	25
24AIMLPRJ801B	PRJ	Major Project 2	-	-		75	50	125
		Total	**80**	**80**	**240**	**150**	**150**	**700**

Department Level Optional Courses

Course Code	Department Level Optional Course 5	Course Code	Department Level Optional Course 6
24AIMLPEC8011B	AI for Financial & Banking Application	24AIMLPEC8021B	Graph Data Science
24AIMLPEC8012B	Quantum Computing	24AIMLPEC8022B	Recommendation Systems
24AIMLPEC8013B	Reinforcement Learning	24AIMLPEC8023B	Social Media Analytics

Course Title: Advanced Artificial Intelligence												
Semester: VIII			Term: Even			Course Code: 24AIMLPCC801B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination ESE:
End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To relate with the basic concepts of Probabilistic Models.
2. To understand the scope of Generative Networks in the field of AI.
3. To recognize various components of Autoencoder Architecture and Training process.
4. To learn the fundamentals of Transfer Learning.
5. Provide students with a comprehensive understanding of ensemble methods and their applications.
6. To explore the nascent applications of AI.

Course Outcomes: After successful completion of the course students will be able to:

1. Acquire basic knowledge of Probabilistic Models.
2. Analyze the working and architecture for Generative Networks.
3. Interpret various components and various types of Autoencoders.
4. Understand various aspects of Transfer Learning.
5. Apply ensemble learning techniques to real-world problems and demonstrate improved predictive performance.
6. Relate to the nascent technologies in the field of artificial intelligence.

Module		Contents	Hours	COs
I		**Generative and Probabilistic Models**	9	CO1
	1.1	**Introduction:** Overview of generative models and their importance in AI, Fundamentals of Probability theory and generative modelling, Introduction to GANs, VAEs and other generative models. Significance of generative models, Challenges with generative models.		
	1.2	**Probabilistic Models:** Gaussian Mixture Models (GMMs), Hidden Markov Models (HMMs), Bayesian Networks, Markov Random Field (MRFs), Probabilistic Graphical Model. **Self-Learning Topics:** Study on Energy-Based Models, Diffusion Models and Their Applications		
II		**Generative Adversarial Network**	8	CO2
	2.1	**Basics of GAN:** Generative Adversarial Networks (GANs) architecture, The discriminator model and generator model, Architecture and Training GANs, Vanilla GAN Architecture. GAN variants and improvements		

		(DCGAN, WGAN, Conditional GAN, Cycle GAN), Challenges- Training instability and model collapse, GAN applications in image synthesis and style transfer **Self-Learning Topics:** GAN Objective Function and Optimization Challenges		
III		**Variational Autoencoders**	8	CO3
	3.1	**Introduction:** Basic components of Variational Autoencoders (VAEs), Architecture and training of VAEs the loss function, Latent space representation and inference, Applications of VAEs in image generation.		
	3.2	**Types of Autoencoders:** Undercomplete autoencoders, Sparse autoencoders, Contractive autoencoders, Denoising autoencoders, Variational Autoencoders (for generative modelling) **Self-Learning Topics:** Study on Conditional VAEs, Beta-VAE, Discrete VAE,VQ-VAE		
IV		**Transfer Learning**	6	CO4
	4.1	**Introduction to transfer learning** Basic terminologies, Pre-trained model and data sets, Feature extraction and fine tune transfer learning, Recent advancement in transfer learning: self-supervised learning and meta learning.		
	4.2	**Self-Learning Topics:** Understanding of Fine-tuning and Feature Extraction in Transfer Learning		
V		**Ensemble learning**	7	CO5
	5.1	**Ensemble Classifiers:** Introduction to Ensemble Methods. Bagging and random forests, **Boosting algorithms :** AdaBoost Stacking and blending models, Extreme Gradient **Boosting (XGBoost):** XGBoost Regression and classification.		
	5.2	**Self-Learning Topics:** Applications of Ensemble Learning, Sequential Training in Boosting, Study on Light GBM, Cross validation in stacking		
VI		**Nascent Technologies in AI**	7	CO6
	6.1	**Convergence of AI with Augmented / Virtual reality techniques for product and process development** Limitations of 2D Learning Environments, Evolution of virtual worlds and immersive technologies, Definition and concepts of Augmented Reality, Definition and concept of the Metaverse, Characteristics and components of the Metaverse, Challenges and opportunities in the Metaverse ecosystem, AI in the realm of emerging quantum computing paradigms		
	6.2	**Self-Learning Topics:** Explainable AI and Ethical AI, Quantum Machine Learning (QML), Neuromorphic Computing		
		Total	**45**	

Exp. No.	List of Experiments	COs
1.	Design and implement a Hidden Markov Models for outcome prediction.	CO1
2.	Design and implement a Bayesian Network for outcome prediction.	CO1
3.	Design and implement a Gaussian Mixture Models for outcome prediction.	CO2
4.	Build and Train a Generative Multi-Layer Network Model using appropriate dataset.	CO3
5.	Build and Train a Deep Convolution Generative Multi-Layer (DCGAN) Network Model for an image based dataset.	CO5
6.	Develop a Conditional GAN (CGAN) Network to direct the image generation process of the generator model.	CO4, CO6
7.	Train a variational autoencoder using TensorFlow on Fashion MNIST	CO1, CO3
8.	Explore the working of any pre-trained model towards outcome generation.	CO1, CO3
9.	Implement and analyze the working of Local Interpretable Model-agnostic Explanations (LIME) supervised model.	CO1, CO3
10.	Case-study on the emerging technologies in AI like Metaverse, Augmented reality etc.	CO1 to CO6
11.	Mini Project Report: For any one chosen real world application as per the syllabus of CSC801: Advanced AI.	
12.	Implementation and Presentation of Mini Project.	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review

9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Xiong, J., Hsiang, E.L., He, Z., Zhan, T. and Wu, S.T., 2021. Augmented reality and virtual reality displays: emerging technologies and future perspectives. Light: Science & Applications, 10(1), p.216.
2. Mystakidis, S., 2022. Metaverse. Encyclopedia, 2(1), pp.486-497
3. Gill, S.S., Xu, M., Ottaviani, C., Patros, P., Bahsoon, R., Shaghaghi, A., Golec, M., Stankovski, V., Wu, H., Abraham, A. and Singh, M., 2022. AI for next generation computing: Emerging trends and future directions. Internet of Things, 19, p.100514
4. Mangini, S., Tacchino, F., Gerace, D., Bajoni, D. and Macchiavello, C., 2021. Quantum computing models for artificial neural networks. Europhysics Letters, 134(1), p.10002

Text Books:

1. Foster, D., 2022. Generative deep learning. O'Reilly Media, Inc.
2. Koller, D. and Friedman, N., 2009. Probabilistic graphical models: principles and techniques. MIT press.
3. Goodfellow, I., 2016. Deep Learning-Ian Goodfellow, Yoshua Bengio, Aaron Courville- Google Books
4. Murphy, K.P., 2012. Machine learning: a probabilistic perspective. MIT press.
5. Zhou, Z.H., 2012. Ensemble methods: foundations and algorithms. CRC press.

Useful Links:

1. https://nptel.ac.in/courses/106106201
2. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
3. https://machinelearingmastery.com/what-are-generative-adversarial-networks-gans/

Course Title: AI for Financial & Banking Application												
Semester: VIII			Term: Even			Course Code: 24AIMLPEC8011B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To understand the impact of technology and digitization on financial and banking enterprises.
2. To explore blockchain technologies in the financial sector.
3. To examine digital money transfer mechanisms and GIFT cities.
4. To evaluate the benefits of digitization and cloud services in banking.
5. To analyze enterprise software solutions for financial operations.
6. To study the integration of AI in banking processes

Course Outcomes:

1. Gain knowledge of technology's influence on financial and banking enterprises..
2. Understand the applications of blockchain in the financial sector.
3. Recognize digital money transfer mechanisms and its role in digitization.
4. Evaluate the advantages of digitization and cloud services in banking.
5. Analyze enterprise software solutions for financial operations.
6. Explore the integration of AI in banking processes.

Module		Contents	Hours	COs
I		**Information Technology Infrastructure and Digitization of Financial Banking Enterprises**	5	CO1
	1.1	Digital Technology driven processes, Blockchain technologies for Financial – Banking sector, GIFT cities Digital Money transfer Mechanisms. Digitization/ cloud services and solutions in banking and financial services Profiling enterprise software's in financial and banking enterprises. Building Efficiencies, productivity, and infallibility in financial & Banking operations. Detailed study of various processes which shall be transformed by AI integration in banking and financial services. **Self-Learning Topics:** Introduction to business efficiencies, industrial productivity and high degree reliability systems for competitive Advantage and carbon neutral enterprises.		
II		**Financial Statistics and The Sharpe Ratio**	8	CO2
	2.1	Probability, Combinatorics, Mathematical Expectation, Sample Mean, Standard Deviation, and Variance, Sample Skewness and Kurtosis ,Sample Covariance and Correlation ,Financial Returns ,Capital Asset Pricing Model ,Sharpe Ratio Formula, Time Periods and Annualizing, Ranking Investment Candidates, The Quantmod Package, Measuring Income Statement Growth, Sharpe Ratios for Income Statement Growth **Self-Learning Topics:** Value at Risk (VaR) and Conditional VaR		

III		**Cluster Analysis**	8	CO3
	3.1	K-Means Clustering, Dissecting the K-Means Algorithm Sparsity and Connectedness of Undirected Graph Covariance and Precision Matrices, Visualizing Covariance, The Wishart distribution Glasso Penalization for Undirected Graphs, Running the Glasso Algorithm, Tracking a Value Stock through the Years Regression on Yearly Sparsity , Regression on Quarterly Sparsity , Regression on Monthly Sparsity **Self-Learning Topics:** Fundamentals of Cluster analysis, types of cluster analysis, Cluster Evaluation metrics, Clustering of high dimensional data		
IV		**Gauging the Market Sentiment**	9	CO6
	4.1	Markov Regime Switching Model, Reading the Market Data, Bayesian Reasoning, The Beta Distribution , Prior and Posterior Distributions , Examining Log Returns for Correlation ,Momentum Graphs ,Simulating Trading Strategies, Foreign Exchange Markets , Chart Analytics Initialization and Finalization, Momentum Indicators, Bayesian Reasoning within Positions, Entries, Exils, Profitability, Short-Term Volatility, The State Machine **Self-Learning Topics:** Market Sentiment, Sentiment's role in decision making, sources of market sentiment, VIX and market Fear Gauges		
V		**Trading algorithms**	8	CO4
	5.1	Vectorized Backtesting, Backtesting an SMA-Based Strategy, Backtesting a Daily DNN-Based Strategy Backtesting an Intraday DNN-Based Strategy , Risk Management : Trading Bot , Vectorized Backtesting Event-Based Backtesting ,Assessing Risk , Backtesting Risk Measures , Stop Loss , Trailing Stop Loss , Take Profit **Self-Learning Topics:** Key components of trading algorithm, types of trading algorithms and strategies, statistical models for trading, Optimization technique, Handling market risks and failures		
VI		**Fraud Analytics**	7	CO5
	6.1	Introduction , The Analytical Fraud Model Life Cycle , Model Representation , Traffic Light Indicator Approach, Decision Tables, Selecting the Sample to Investigate, Fraud Alert and Case Management , Visual Analytics, Backtesting **Analytical Fraud Models :** Backtesting Data Stability, Backtesting Model Stability, Backtesting Mode Calibration, Model Design and Documentation **Self-Learning Topics:** Types of fraud detection techniques, Anomaly Detection techniques, data sources for fraud analytics, fraud prevention and Risk management		
		Total	45	

Exp. No.	List of Experiments	COs
1.	Setting up a Digital Money Transfer System	CO1
2.	Calculating Sharpe Ratios for Investment Portfolios	CO2
3.	Cluster Analysis of Financial Data for Market Segmentation	CO3
4.	Analyzing Market Sentiment using the Markov Regime Switching Model	CO3
5.	Developing and Backtesting a Simple Trading Algorithm	CO3

6.	Implementing Advanced Risk Management Techniques in Trading Algorithms	CO4
7.	Fraud Detection using Machine Learning Algorithms	CO1,CO3
8.	Visualizing Fraud Patterns and Analytics	CO1, CO3
9.	Designing and Backtesting Complex Trading Strategies	CO1, CO6
10.	Evaluating and Enhancing the Performance of Trading Algorithms	CO5
11.	Applying Machine Learning for Predictive Fraud Analytics	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam
Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be held.

Reference Books:

1. Machine Learning for Asset Managers by Marcos López de Prado.
2. Advances in Financial Machine Learning by Marcos López de Prado.

Text Books:

1. Financial Analytics with R Building a Laptop Laboratory for Data Science MARK J. BENNETT University of Chicago DIRK L. HUGEN University of Iowa
2. Artificial Intelligence in Finance A Python-Based Guide, Yves Hilpisch A
3. Fraud Analytics Using Descriptive, Predictive, and Social Network Techniques: A Guide to Data Science for Fraud Detection, Bart Baesens, Veronique Van Vlasselaer, Wouter Verbeke

Useful Links:

1. https://www.eastnets.com/newsroom/digital-transformation-in-the-banking-and-financial-services-sector
2. https://www.techopedia.com/definition/34633/generative-ai

Course Title: Quantum Computing												
Semester: VIII			**Term: Even**				**Course Code: 24AIMLPEC8012**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	**-**	**2**	**3**	**-**	**1**	**4**	**20**	**20**	**60**	**25**	**25**	**150**

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To understand basics of quantum computing.
2. To understand mathematics required for quantum computing
3. To understand building blocks of quantum computing and design algorithms
4. To understand quantum hardware principles and tools for quantum computing.

Course Outcomes: After successful completion of the course students will be able to:

1. Understand basic concepts of quantum computing
2. Illustrate building blocks of quantum computing through architecture and programming models.
3. Appraise various mathematical models required for quantum computing
4. Discuss various quantum hardware building principles
5. Identify the various quantum algorithms
6. Describe usage of tools for quantum computing.

Module		Contents	Hours	COs
I		**Introduction to Quantum Computing**	8	CO1
	1.1	Motivation for studying Quantum Computing Origin of Quantum Computing Quantum Computer vs. Classical Computer Introduction to Quantum mechanics Overview of major concepts in Quantum Computing		
	1.2	Qubits and multi-qubits states Bloch Sphere representation Quantum Superposition Quantum Entanglement Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.) **Self-Learning Topics:** Quantum computing definition, Quantum states and measurements, Challenges of Quantum Computing, Application of Quantum Computing		
II		**Mathematical Foundations for Quantum Computing**	6	CO2
	2.1	Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors. **Self-Learning Topics:** Application of Complex Numbers in Quantum Mechanics, Linear transformations and Quantum Gates, Case studies of Quantum algorithms and their mathematical foundations		
III		**Building Blocks for Quantum Program**	9	CO3
	3.1	Architecture of a Quantum Computing platform Details of q-bit system of information representation: Block Sphere Multi-qubits States Quantum superposition of qubits (valid		

		and invalid superposition) Quantum Entanglement Useful states from quantum algorithmic perceptive e.g. Bell State Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit No Cloning Theorem and Teleportation		
	3.2	Programming model for a Quantum Computing Program Steps performed on classical computer Steps performed on Quantum Computer Moving data between bits and qubits. **Self-Learning Topics:** Potential applications of teleportation in quantum networks, Study resources on error mitigation and quantum measurement in Qiskit or Cirq.		
IV		**Quantum Algorithms and Error correction**	6	CO4
	4.1	Quantum Algorithms, Shor's Algorithm, Grover's Algorithm. Deutsch's Algorithm, Deutsch -Jozsa Algorithm		
	4.2	Quantum error correction using repetition codes 3 qubit codes, Shor's 9 qubit error correction Code **Self-Learning Topics:** Effects of measurement on quantum states, Analysis of speedup compared to classical algorithms, Need of error correction in quantum computing, Fault Tolerant quantum computing		
V		**Quantum Hardware**	6	CO5
	5.1	Ion Trap Qubits ,The DiVincenzo Criteria , Lagrangian and Hamiltonian Dynamics in a Nutshell: Dynamics of a Translating Rotor		
	5.2	Quantum Mechanics of a Free Rotor: A Poor Person's Atomic		
	5.3	Model: Rotor Dynamics and the Hadamard Gate, Two-Qubit Gates The Cirac-Zoller Mechanism: Quantum Theory of Simple Harmonic Motion, A Phonon-Qubit Pair Hamiltonian, Light- Induced Rotor-Phonon Interactions, Trapped Ion Qubits, Mølmer- Sørenson Coupling ..		
	5.4	Circuit QED (cirQED): Quantum LC Circuits, Artificial Atoms, Superconducting Qubits Quantum computing with spins: Quantum inverter realized with two exchange coupled spins in Quantum dots, A 2-qubit spintronic universal quantum gate. **Self-Learning Topics:** Superconducting Qubits, Trapped Ions, Topological Qubits, Cryogenics in Quantum Computing, Benchmarking Quantum Devices		
VI		**OSS Toolkits for implementing Quantum program**	4	CO6
	6.1	IBM quantum experience Microsoft Q,Rigetti PyQuil (QPU/QVM) **Self-Learning Topics:** Importance of OSS in quantum computing, Overview of the Forest platform and QVM (Quantum Virtual Machine), Use cases and scenarios for choosing a toolkit		
		Total	**45**	

Exp. No.	List of Experiments	COs
1.	Building Quantum dice	CO1
2.	Building Quantum Random No. Generation	CO2
3.	Composing simple quantum circuits with q-gates and measuring the output into classical bits.	CO3
4.	Implementation of Shor's Algorithms	CO3
5.	Implementation of Grover's Algorithm	CO3
6.	Implementation of Deutsch's Algorithm	CO4
7.	Implementation of Deutsch-Jozsa's Algorithm	CO4
8.	Quantum Circuits	CO4
9.	Qubit Gates	CO5
10.	Bell Circuit & GHZ Circuit	CO2
11.	Accuracy of Quantum Phase Estimation	CO6
12.	Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm.	CO1to CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam
Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Bernard Zygelman, A First Introduction to Quantum Computing and Information,2018
2. Supriyo Bandopadhyay and Marc Cahy, Introduction to Spintronics, CRC Press, 2008
3. The Second Quantum Revolution: From Entanglement to Quantum Computing and Other Super-Technologies, Lars Jaeger
4. La Guardia, Giuliano Gladioli, Quantum Error correction codes, Springer 2021

Text Books:

1. Michael A. Nielsen, Quantum Computation and Quantum Information, Cambridge University Press.
2. David McMahon, Quantum Computing Explained, Wiley, 2008
3. Qiskit textbook https://qiskit.org/textbook-beta/
4. Vladimir Silva, Practical Quantum Computing for Developers, 2018

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
2. https://www.coursera.org/courses?query=quantum%20computing
3. https://www.cl.cam.ac.uk/teaching/1617/QuantComp/

Course Title: Reinforcement Learning												
Semester: VIII			Term: Even				Course Code: 24AIMLPEC8013B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives:

1. Learn about robots as an agent of automation and other Use cases
2. Design and Development of robots based on Direct and Inverse Kinematics
3. Learn the different types of Actuators, Sensors, and degree of freedom of Robots
4. Learn the concepts of Motions, Velocities and Dynamic/ force analysis of Robots
5. Learn algorithms governing Robot movements and Robot Programming
6. Learn about integration of electronics and communication devices for multimodal functions

Course Outcomes: After successful completion of the course students will be able to:

1. Understand different types of robots, specifications of Robots its characteristics and applications.
2. Understanding Direct – Inverse kinematics of robotic manipulator.
3. Identify actuators, sensors, and control of a robot for different applications
4. Developing the differential relationships of motion, velocities and dynamic analysis of force
5. Developing perspectives on AI and Robotics
6. Developing footprints of algorithms, programming associated with Robots and conceptualizing self-configuring Robots and use of Robots in different applications

Module		Contents	Hours	COs
I		**Introduction and Fundamentals of Robotics and Automation**	5	CO1
	1.1	Automation and its types, definition of Robotics and a Robot, History of Robotics, Advantages and Disadvantages of Robot, Robotic Manipulators, Robot Motions, Robot Anatomy, Links and Joints, Classification of Robots, Specification of Robot, Applications of Robots **Self-Learning Topics:** Current Trends in Robotics and Automation Technologies, Differences and Overlaps Between Robotics and Automation		
II		**Direct and Inverse Kinematics**	8	CO2
	2.1	Direct (Forward) Kinematics: Homogeneous coordinates, Link coordinates, Coordinate frame, coordinate transform, Arm equations, An example – Four Axis SCARA.		
	2.2	Inverse Kinematics: Inverse kinematics problem, Tool Configuration, An example – Four Axis SCARA. **Self-Learning Topics:** Distinction Between Direct (Forward) and Inverse Kinematics, Applications of Kinematics		
III		**Actuators and Sensors**	8	CO3
	3.1	Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic Devices, Pneumatic Devices, Electric Motors, Magneto		

		strictive Actuators		
	3.2	Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Force and Pressure Sensors, Torque Sensors, Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors, Sniff Sensors, Vision Systems, Voice Synthesizer **Self-Learning Topics:** Importance in Robotic Systems, Advanced Control Systems		
IV		**Motions, velocities and dynamic analysis of force**	8	CO4
	4.1	Differential relationship, Jacobian, Differential motions of a frame and robot, Inverse Jacobian, Lagrangian mechanics, Moments of Inertia, Dynamic equations of robots, Transformation of forces and moment between coordinate frames **Self-Learning Topics:** Importance of Motion Analysis, Workspace Analysis		
V		**Self-configuring Robots and AI integration**	9	CO5
	5.1	Historical perspective of AI in Robotics, Uncertainty in Robotics Reinforcement Learning: Basic overview, examples, elements, Tabular Solution Methods - Multiarmed bandits, Finite Markov decision process, Dynamic programming (Policy Evaluation, Policy Iteration, Value Iteration), Monte Carlo Methods. **Self-Learning Topics:** Decision-Making in Dynamic Environments, Predictive Maintenance with AI		
VI		**Applications of Robotics for Automation**	7	CO6
	6.1	Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading Processing - spot and continuous arc welding & spray painting – Assembly Inspection, Selected Embedded System based Applications: Database Applications (smart cards), Process-Control (Fuzzy logic), Robot application in Medical, Industrial Automation, Security **Self-Learning Topics:** Cobots in Assembly, Pick-and-Place Robots		
		Total	45	

Exp. No.	List of Experiments	COs
1.	Implementing a simple grid-world environment and training an agent using basic Q-learning	CO1
2.	Implementing a multi-armed bandit problem and comparing different exploration strategies like epsilon-greedy and UCB.	CO2
3.	Implementing a basic grid-world environment as an MDP and applying policy iteration and value iteration algorithms to find optimal policies.	CO3
4.	Applying dynamic programming algorithms, such as policy evaluation and policy Improvement, to solve a small-scale MDP problem.	CO4
5.	Implementing Monte Carlo control and Temporal Difference (TD) learning algorithms to	CO4

	train an agent in a grid-world environment.	
6.	Exploration vs. Exploitation Trade-off: Experimenting with different exploration strategies and analyzing their impact on the learning performance of an agent in a bandit problem.	CO4
7.	Function Approximation in Reinforcement Learning: Using function approximation techniques, such as linear regression or neural networks, to approximate value functions in reinforcement learning problems.	CO4
8.	Deep Reinforcement Learning: Implementing a deep Q-network (DQN) to train an agent to play a popular Atari game, such as Pong or Space Invaders.	CO4
9.	Transfer Learning and Multi-Task Reinforcement Learning: Investigating transfer learning in reinforcement learning by training an agent in one environment and transferring its knowledge to a different but related environment	CO5
10.	Policy Gradient Methods: Implementing policy gradient methods, such as REINFORCE or Proximal Policy Optimization (PPO), to train an agent in a continuous control environment.	CO5
*11.	Applications and Case Studies: Applying reinforcement learning techniques to solve a real-world problem, such as training a self-driving car to navigate a simulated road environment.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review

9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. John J. Craig, "Introduction to Robotics: Mechanics & Control", 3rd Edition, Pearson Education, India, 2009
2. Mark W. Spong & M. Vidyasagar, "Robot Dynamics & Control", 2nd Wiley India Pvt. Ltd., 2004
3. Principles of Robot Motion – Theory, Algorithms and Implementation by Howie Choset, Lynch, PHI.

Text Books:

1. Robert Shilling, "Fundamentals of Robotics-Analysis and control", PHI, 2003.
2. Saeed B. Niku, "Introduction to Robotics Analysis, Systems, Applications", 3rd Edition, Wiley, 2019.
3. Saha, S.K., "Introduction to Robotics", 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
4. Staughard, Robotics and AI, Prentice Hall of India
5. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, Sixth impression, 2010.
6. Mukherjee S., "Robotics Process Automation", 1st Edition, Khanna Publishing House, New Delhi, 2020.

Useful Links:

1. https://swayam.gov.in/nc_details/NPTEL
2. https://www.udemy.com/course/robotics-course/
3. https://www.learndatasci.com/out/coursera-machine-learning/
4. https://www.coursera.org/courses?query=robotics

Course Title: Graph Data Science												
Semester: VIII			**Term: Even**				**Course Code: 24AIMLPEC8021B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	**-**	**2**	**3**	**-**	**1**	**4**	**20**	**20**	**60**	**25**	**25**	**150**

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To understand the basics of graphs, including definitions, connectivity, and properties.
2. To explore the use of graphs in solving puzzles and optimization problems.
3. To learn about the advantages of graph databases over relational and NoSQL databases.
4. To Gain knowledge of data modelling with graphs, including the labeled property graph model.
5. To develop skills in building graph database applications, including data modelling and testing.
6. To explore real-world use cases and understand non-functional characteristics of graph databases.

Course Outcomes: Learner will be able to

1. Demonstrate a solid understanding of graph concepts and properties.
2. Apply graph algorithms to solve puzzles and optimization problems.
3. Compare graph databases with relational and NoSQL databases.
4. Model data using the labeled property graph model and avoid common pitfalls.
5. Build graph database applications with proper data modeling and testing.
6. Analyze and implement graph database solutions for real-world use cases, considering non-functional characteristics

Module		Contents	Hours	COs
I		**Introduction to Graph**	5	CO1
	1.1	Definitions and examples, Three puzzles, Paths and cycles, Connectivity, Eulerian graphs, Hamiltonian graphs, shortest path, Chinese postman problem, traveling salesman problem, trees, properties of trees **Self-Learning Topics:** Graph-Based Learning, Graph Neural Networks (GNNs)		
II		**Introduction Graph databases**	8	CO2
	2.1	A High-Level View of the Graph Space, Graph Databases, Graph Compute Engines, The Power of Graph Databases, Performance, Flexibility, Agility, Options for Storing Connected Data, Relational Databases Lack Relationships, NOSQL Databases also Lack Relationships, Graph databases embraces relationship **Self-Learning Topics:** Native Graph Databases, Non-Native or Multi-Model Databases		
III		**Data Modelling with Graphs**	8	CO3
	3.1	Models and Goals, The Labelled Property Graph Mode Querying Graphs, A Comparison of Relational and Graph Modelling, Cross-Domain Models, Common Modelling Pitfalls, Identifying Nodes and Relationships, Avoiding Anti-Patterns **Self-Learning Topics:** Entity-Relationship (ER) Model Translation, Modeling Complex Relationships		
IV		**Building a Graph Database Application**	8	CO4

	4.1	Data Modelling, Application Architecture, Testing, Capacity Planning, Importing and Bulk Loading Data **Self-Learning Topics:** Data Migration from Relational Databases, Batch Loading Technique		
V		**Graphs in the Real World**	8	CO5
	5.1	Organizations Choose Graph Databases, Common Use Cases, Real-World Examples, Authorization and Access Control, Geospatial and Logistics, Graph Database Internals, Native Graph Processing, Native Graph Storage Programmatic APIs, Kernel API, Core API, Traversa Framework, Non-functional Characteristics **Self-Learning Topics:** Modeling Social Networks, Influencer Analysis		
VI		**Case study**	8	CO6
	6.1	Neo4j - About, Neo4j – Installation, Neo4j - Browser Neo4j - Query Language (Cypher), Neo4j - Create a Node Neo4j - Create a Relationship, Neo4j - Create an Index Neo4j - Create a Constraint, Neo4j - Select Data with MATCH, Neo4j - Import Data from CSV, Neo4j - Drop an Index, Neo4j - Drop a Constraint, Neo4j - Delete a Node, Neo4j - Delete a Relationship **Self-Learning Topics:** Case study based on real-time examples		
		Total	45	

Exp. No.	List of Experiments	COs
1.	**Graph Database Fundamentals:** • Install and set up a graph database system (e.g., Neo4j) on a local machine. • Familiarize yourself with the graph database environment, including the cquery language (Cypher) and browser interface.	CO1
2.	**Data Modeling with Graphs:** • Design a data model using the labeled property graph model for a specific domain (e.g., social network, e-commerce). • Implement the data model in the graph database and populate it with sample data	CO2
3.	**Basic Graph Queries:** • Perform basic graph queries using Cypher to retrieve nodes, relationships, and their properties. • Explore different query patterns, such as finding paths, filtering nodes, and ordering results.	CO3
4.	**Advanced Graph Queries:** • Extend your query knowledge by performing more complex graph queries, including subgraph matching, aggregation, and conditional filtering. • Optimize query performance by understanding and utilizing indexes.	CO4

5.	**Graph Database Administration:** • Learn and practice essential administrative tasks, such as managing users, roles, and access control. • Perform backup and restore operations to ensure data integrity	CO4
6.	**Importing and Exporting Data:** • Import data from external sources (e.g., CSV files) into the graph database. • Export graph data to different formats for analysis or sharing.	CO4
7.	**Graph Algorithms and Analytics:** • Explore the built-in graph algorithms provided by the graph database system (e.g., centrality, community detection). • Apply graph algorithms to analyze and extract insights from your graph data	CO4
8.	**Graph Visualization and Exploration:** • Utilize visualization tools and libraries to visualize your graph data. • Explore and navigate the graph visually to gain a better understanding of its structure and relationships.	CO4
9.	**Performance Optimization:** • Identify and address performance bottlenecks in your graph database application. • Optimize queries, indexes, and data modeling to improve overall system performance.	CO5
10.	**Scaling and Replication:** • Learn techniques for scaling and replicating a graph database to handle larger datasets and higher workloads. • Implement and test replication strategies to ensure data availability and fault tolerance.	CO5
11.	**Real-World Use Cases:** • Choose a specific real-world use case (e.g., recommendation systems, fraud detection) and apply graph database techniques to solve the problem. • Design and implement a graph database application that addresses the unique requirements of the chosen use case.	CO1 to CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Graph Databases: New Opportunities for Connected Data by Ian Robinson, Jim Webber, and Emil Eifrém.
2. Neo4j in Action by Aleksa Vukotic, Nicki Watt, and Tareq Abedrabbo.
3. Graph Databases for Beginners by Mark Needham and Amy E. Hodler.
4. Practical Neo4j by Gregory Jordan.
5. Learning Neo4j by Rik Van Bruggen.
6. Graph Database Applications and Concepts with Neo4j by Dionysios Synodinos.

Text Books:

1. Introduction to Graph Theory Fourth edition, Robin J. Wilson
2. Daphne Koller and Nir Friedman, "Probabilistic Graphical Models: Principles and Techniques",
3. Graph databases, Ian Robinson, Jim Webber & Emil Eifrem

Useful Links:

1. https://web4.ensiie.fr/~stefania.dumbrava/OReilly_Graph_Databases.pdf
2. https://www.quackit.com/neo4j/tutorial/

Course Title: Recommendation Systems												
Semester: VIII			Term: Even			Course Code: 24AIMLPEC8022B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To introduce Recommendation systems and its basic concepts.
2. To understand design and working of Collaborative Filtering based recommendation.
3. To analyze design and working of Content-based recommendation.
4. To understand design and working of Knowledge based recommendation.
5. To understand design and working of Ensembled- Based and Hybrid Recommendation Systems.
6. To identify the methods for evaluation of recommendation systems.

Course Outcomes: Learner will be able to

1. To have a broad understanding of the field of Recommendation Systems.
2. In-depth Knowledge of the architecture and models for Collaborative Filtering.
3. Understanding the architecture and working of Content based recommendation systems.
4. Understanding the architecture and basics of Knowledge based recommendation systems.
5. Analyzing hybrid and ensembles recommendation systems.
6. Evaluation of recommendation systems by selecting right evaluation parameter.

Module		Contents	Hours	COs
I		**Introduction to Recommendation System**	7	CO1
	1.1	History of recommendation system, Eliciting Ratings and other Feedback Contributions, Implicit and Implicit Ratings, Recommender system functions.		
	1.2	Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system. **Self-Learning Topics:** Matrix Factorization Techniques, Advantages and challenges of collaborative filtering method		
II		**Collaborative Filtering**	7	CO2
	2.1	Architecture of Collaborative Filtering, User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Clustering for recommendation system, Attacks on collaborative recommender systems, Advantages and drawbacks of Collaborative Filtering. **Self-Learning Topics:** Advantages and challenges of collaborative filtering methods, Item-Based Collaborative Filtering		
III		**Synchronization**	8	CO3

	3.1	Architecture of content-based systems, Content representation and content similarity, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, The Role of User		
		Generated Content in the Recommendation Process		
	3.2	Bayes classifier for recommendation, Regression based recommendation system. Advantages and drawbacks of content-based filtering **Self-Learning Topics:** Synchronization in Multi-Core System, Quantum Synchronization		
IV		**Knowledge based recommendation**	7	CO4
	4.1	Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders, Persistent Personalization in Knowledge-Based Systems, Conversational Recommendation. Search based recommendation, Navigation-based recommendation **Self-Learning Topics:** Collaborative Knowledge-Based Methods, Cold Start Problem		
V		**Ensembled- Based and Hybrid Recommendation System**	7	CO5
	5.1	Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies **Self-Learning Topics:** Advantages on pipelined hybridization design		
VI		**Evaluating Recommendation System**	9	CO6
	6.1	Characteristics and properties of evaluation research, Evaluation design goals- Accuracy, Coverage, Confidence and Trust, Novelty, Serendipity, Diversity, Robustness, Stability and Scalability.		
	6.2	Comparison between evaluation design of classification model and recommendation system, Error metrics, Decision-Support metrics, User-Centred metrics. Comparative analysis between different types of recommendation systems. **Self-Learning Topics:** Advantages on decision-support metrics, advantages of user-centred metrics		
		Total	45	

Sr. No.	**List of Experiments**	**COs**
1.	Implementation of Matrix operations and data representation towards understanding mathematics for recommendation system	CO1
2.	Experiment on the role of clustering methods with respect to recommendation systems	CO2
3.	Feature engineering and pre-processing of data for recommendation systems.	CO3
4.	Implementation of Bayes classifier for recommendation.	CO4

5.	Implement User-based Nearest neighbour recommendation.	CO4
6.	Implement Item-based Nearest neighbour recommendation	CO4
7.	Implement Content-based recommendation system.	CO4
8.	Implement Knowledge-based recommendation system.	CO4
9.	Implementation of a recommendation system using Hybrid approach.	CO5
10.	Implementation of a recommendation system using Ensembled approach.	CO5
11.	Implementation of a Regression based recommendation system.	CO6
12.	Analyze results on the basis of different evaluation parameters and graphical Representations for recommendation systems.	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Aggarwal, C. C. (2016). Recommender systems (Vol. 1). Cham: Springer International Publishing.

Text Books:

1. Jannach, D., Zanker, M., Felfernig, A., & Friedrich, G. (2010). Recommender systems: an introduction. Cambridge University Press
2. Ricci, F., Rokach, L., & Shapira, B. (2011). Introduction to Recommender Systems Handbook. Springer, Boston, MA

Useful Links:

1. http://www.iem.iitkgp.ac.in/eco/Recommender_Systems/
2. https://www.coursera.org/specializations/recommender-systems
3. https://www.udemy.com/course/recommender-systems/
4. https://www.analyticsvidhya.com/blog/2021/08/developing-a-course-recommender-system-using-python/

Course Title: Social Media Analytics												
Semester: VIII			Term: Even			Course Code: 24AIMLPEC8023B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: Learner will be able to

1. Familiarize the learners with the concept of social media.
2. Familiarize the learners with the concept of social media analytics and understand its significance.
3. Enable the learners to develop skills required for analyzing the effectiveness of social media.
4. Familiarize the learners with different tools of social media analytics.
5. Familiarize the learner with different visualization techniques for Social media analytics.
6. Examine the ethical and legal implications of leveraging social media data.

Course Outcomes: Learner will be able to

1. Understand the concept of Social media
2. Understand the concept of social media Analytics and its significance.
3. Learners will be able to analyze the effectiveness of social media.
4. Learners will be able to use different Social media analytics tools effectively and efficiently.
5. Learners will be able to use different effective Visualization techniques to represent social media analytics.
6. Acquire the fundamental perspectives and hands-on skills needed to work with social media data.

Module		Contents	Hours	COs
I		**Social Media Analytics: An Overview**	7	CO1
	1.1	Core Characteristics of Social Media, Types of Social Media, Social media landscape, Need for Social Media Analytics (SMA), SMA in small & large organizations. Purpose of Social Media Analytics, Social Media vs. Traditional Business Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle, Challenges to Social Media Analytics, Social Media Analytics Tools **Self-Learning Topics:** Social media analytics cycle		
II		**Social Network Structure, Measures & Visualization**	7	CO2
	2.1	Basics of Social Network Structure - Nodes, Edges & Tie Describing the Networks Measures - Degree Distribution, Density, Connectivity, Centralization, Tie Strength & Trust Network Visualization - Graph Layout, Visualizing Network features, Scale Issues. Social Media Network Analytics - Common Network Terms, Common Social Media Network Types, Types of Networks, Common Network Terminologies, Network Analytics Tools. **Self-Learning Topics:** Visualizing Network Features, Advanced Audience Segmentation in Social Media		
III		**Social Media Text, Action & Hyperlink Analytics**	9	CO3

	3.1	Social Media Text Analytics - Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics, Social Media Text Analysis Tools Social Media Action Analytics - What Is Actions Analytics? Common Social Media Actions, Actions Analytics Tools Social Media Hyperlink Analytics - Types of Hyperlinks, Types of Hyperlink Analytics, Hyperlink Analytics Tools **Self-Learning Topics:** Advanced NLP Techniques in Social Media Text Analytics, Text Analytics for Spam and Bot Detection		
IV		**Social Media Location & Search Engine Analytics**	7	CO4
	4.1	Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics and Privacy Concerns, Location Analytics Tools Search Engine Analytics - Types of Search Engines, Search Engine Analytics, Search Engine Analytics Tools **Self-Learning Topics:** Geospatial Data Types and Quality Analysis, Ethical and Regulatory Frameworks in Location Analytics ,Content Gap Analysis and Competitor Benchmarking		
V		**Social Information Filtering**	7	CO5
	5.1	Social Information Filtering - Social Sharing and filtering , Automated Recommendation systems, Traditional Vs social Recommendation Systems Understanding Social Media and Business Alignment, Social Media KPI, Formulating a Social Media Strategy, Managing Social Media Risks **Self-Learning Topics:** Collaborative Filtering Techniques in Social Media ,.Risk Assessment and Crisis Management in Social Media		
VI		**Social Media Analytics Applications and Privacy**	8	CO6
	6.1	Social media in public sector - Analyzing public sector social media, analysing individual users, case study. Business use of Social Media - Measuring success, Interaction and monitoring, case study. Privacy - Privacy policies, data ownership and maintaining privacy Online **Self-Learning Topics:** Crisis Communication and Emergency Management on Social Media, Public Sentiment Analysis and Policy Feedback		
		Total	45	

Exp. No.	**List of Experiments**	**COs**
1.	Study various – 1. Social Media platforms (Facebook, twitter, YouTube etc.) 2. Social Media analytics tools (Facebook insights, google analytics, etc.) 3. Social Media Analytics techniques and engagement metrics (page level, post level, member level) 4. Applications of Social media analytics for business. e.g. Google Analytics	CO1

	https://marketingplatform.google.com/about/analytics/ https://netlytic.org/	
2.	Data Collection-Select the social media platforms of your choice (Twitter, Facebook, LinkedIn, YouTube, Web blogs etc) ,connect to and capture social media data for business (scraping, crawling, parsing)	CO2
3.	Data Cleaning and Storage- Preprocess, filter and store social media data for business (Using Python, MongoDB, R, etc).	CO3
4.	Exploratory Data Analysis and visualization of Social Media Data for business.	CO4
5.	Develop Content (text, emoticons, image, audio, video) based social media analytics model for business. (e.g. Content Based Analysis :Topic , Issue ,Trend, sentiment/opinion analysis, audio, video, image analytics.)	CO4
6.	Develop Structure based social media analytics model for any business. (e.g. Structure Based Models -community detection, influence analysis)	CO4
7.	Develop a dashboard and reporting tool based on real time social media data.	CO4
8.	Design the creative content for promotion of your business on social media platform.	CO4
9.	Develop social media text analytics models for improving existing product/ service by analyzing customer's reviews/comments.	CO5
10.	Social Media Analysis for Public Sector — Monitoring, User Analysis & Privacy Assessment	CO6

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COs / LOs should be covered)
Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom

8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

Note: Number of activities to be conducted under TAE would be as per the subject need.

D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

Reference Books:

1. Social Media Analytics [2015], Techniques and Insights for Extracting Business Value Out of Social Media, Matthew Ganis, Avinash Kohirkar, IBM Pres
2. Social Media Analytics Strategy_ Using Data to Optimize Business Performance, Alex Gonçalves, A Press Business Team.
3. Social Media Data Mining and Analytics, Szabo, G., G. Polatkan, O. Boykin & A. Chalkiopoulus (2019), Wiley, ISBN 978-1-118-82485-6

Text Books:

1. Seven Layers of Social Media Analytics_ Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data, Gohar F. Khan (ISBN-10: 1507823207)
2. Analyzing the Social Web 1st Edition by Jennifer Golbeck
3. Mining the Social Web_ Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites, Matthew A Russell, O'Reilly
4. Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 201

Useful Links:

1. https://cse.iitkgp.ac.in/~pawang/courses/SC16.html
2. https://onlinecourses.nptel.ac.in/noc20_cs78/preview
3. https://nptel.ac.in/courses/106106146
4. https://7layersanalytics.com/

Course Title: Employability Enhancement Program III (Industry Certification)												
Semester: VIII			Term: Even				Course Code: 24AIMLVSE602					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/TU	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	2	-	-	1	1	-	-	-	-	25	25

Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

Course Objectives: The objectives of this course are to

7. Develop Professional Skills
8. Enhance Technical Competency
9. Cultivate Problem-Solving Abilities
10. Promote Ethical and Professional Conduct
11. Familiarize with Industry Standards and Expectations
12. Prepare for a Transition from Classroom to Workplace

Course Outcomes: After completion of this course, students will be able to

7. Communicate and Collaborate Effectively
8. Acquire Job-Ready Technical Skills
9. Enhanced Critical Thinking and Problem-Solving
10. Understand Ethical and Professional Standards
11. Use Industry Tools and Standards
12. Industry Integration effectively

Certification Guidelines:

The general procedure for organizing certification courses is as follows:

1. **Identification of Industry Partners**
   Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.
2. **Selection of Certification Domain**
   Students can choose two domains of their interest for the certification course and express their willingness to pursue the certification.
   Following combination of domains are offered in the even semesters:

Tracks	Domain 1	Domain 2
Track 1	SQL	Dotnet
Track 2	CCNA	AI-IBM

Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works
Track 5	Data Science	Prompt Engineering and AI
Track 6	MERN Stack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IOT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MERN Stack
Track 13	Microsoft Tools	AI-IBM
Track 14	Augmented Reality	Virtual Reality
Track 15	Professional Edge Training (PET)	

3. **Allocation of Tracks**

   Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.

4. **Course Duration**

   Students have to complete the certification course, which has a minimum duration of 30 hours.

5. **Oral & Practical Exam**

   Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

Note: A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.

Course Title: Project Management												
Semester: VIII			Term: Even			Course Code: 24ILO8021B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. Understanding the Foundations of Project Management
2. Developing Leadership and Interpersonal Skills
3. Mastering Project Planning and Risk Management
4. Enhancing Monitoring, Evaluation, and Software Proficiency

Course Outcomes:

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

1. Demonstrate an understanding of project management principles and models
2. Exhibit leadership and interpersonal skills
3. Plan and execute projects effectively
4. Utilize advanced scheduling and resource management techniques
5. Implement project monitoring and control mechanisms
6. Leverage software and simulation tools

Module	Contents	Hours	COs
I	**Introduction to project management:** Introduction to project management - I, introduction to project management - II, agile project management, project selection models, examples of project selection models	6	CO1
II	**Role of the Project Manager:** Project manager, attributes of effective project manager, managing for stakeholders, resolving conflicts, negotiation, project in the organization structure, human factors and the project team	8	CO2
III	**Comprehensive Project Planning and Risk Management:** Traditional project activity planning, agile project planning, project charter, coordination through integration management, project feasibility analysis, estimating project budgets project risk management, quantitative risk assessment methodologies, critical path method (CPM)	8	CO3

IV	**Advanced Scheduling and Resource Optimization Techniques in Project Management:** Programme evaluation and review technique (PERT), risk analysis with simulation for scheduling, Gantt chart, scheduling with scrum, crashing a project, resource loading, resource levelling Goldratt's critical chain	9	CO4
V	**Project Monitoring, Control, and Closure: Insights and Case Studies:** Planning-monitoring-controlling cycle, earned value analysis, agile tools for tracking project, three types of project-controlling, control of change scope and scope creep, project audit, essentials of an audit/evaluation, when to close a project, benefits realisation, case study on the success of Chandrayan-3.	9	CO5
VI	**Leveraging Software Tools for Effective Project Management:** Software for project management, demo on project management software, simulations software for project management	5	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Book:

1. Project Management (A Strategic Managerial Approach) by Meredith

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_mg71/preview

Course Title: Finance Management												
Semester: VIII			**Term: Even**			**Course Code: 24ILO8022B**						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand financial and cost accounting principles, corporate finance concepts and financial statements. and the preparation and interpretation of financial statements
2. To understand cash flow and analysis of financial statements.
3. To understand and define break even analysis and budgeting.
4. To describe capital structure, risk-return analysis, time value of money, valuation methods for bonds and stocks, compute WCC, evaluate capital investments and analyze dividend policies..

Course Outcomes:

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

1. Explain the concepts related to financial and cost accounting, corporate finance and financial statements.
2. Prepare, interpret and analyze financial and cash flow statements.
3. Apply cost accounting techniques to prepare cost sheets and optimize resource allocation.
4. Explain cost accounting and Allocation and Apportionment of Overheads, prepare a
5. Analyze financial decisions, evaluate risks, and apply valuation techniques for bonds and stocks.
6. Compute WACC, evaluate capital investments, and analyze dividend policies in real-world scenarios.

Module	Contents	Hours	COs
I	**Introduction to Financial and Cost Accounting:** Distinctions Between Financial and Cost/Management Accounting, Processes of Recording Business Transactions, Users of Financial and Cost/Management Accounting Information, Decision-Making Through Cost/Management Accounting **Introduction to Corporate Finance:** Meaning and Functions of Corporate Finance, Fundamentals of the Time Value of Money **Financial Statements Basics:** Recording, Classifying, and Summarizing Transactions, Income Statement and Balance Sheet Concepts, Dual Effect Concept (Double-Entry Bookkeeping), Accrual and Entity Concepts in Accounting	7	CO1
II	**Preparation of Financial Statements:** Classification of Items (Assets, Liabilities, Equity, Revenue, Expenses), Applications of Double-Entry System, Accruals, Depreciation, and Adjustments (Prepaid Expenses, Accrued Interest) **Cash Flow Statements:** Direct and Indirect Methods, Cash Flow from Operating, Investing, and Financing Activities, Analysis of Cash Flow with Income Statement and Balance Sheet **Financial Statement Analysis: Ratio Analysis:** Liquidity, Profitability, Efficiency, Dividend Ratios, Working Capital Management	9	CO2
III	**Introduction to Cost Accounting:** Cost, Costing, and Cost Accounting: Definitions and Purposes, Classification of Costs: Fixed, Variable, Direct, Indirect, Opportunity Costs **Preparation of Cost Sheets:** Prime Cost, Conversion Cost, and Total Cost, Classification of Manufacturing and Non-Manufacturing Costs **Allocation and Apportionment of Overheads:** Primary and Secondary Distribution, Activity-Based Costing (ABC): Concepts, Drivers, and Applications	9	CO3
IV	**Break-Even Analysis:** Contribution Analysis, Cost-Volume-Profit Analysis, Margin of Safety and Operating Leverage **Decision-Making Examples:** Keep or Drop Products, Make or Buy Decisions, Incremental Costs and Relevant Costs **Budgeting:** Types of Budgets: Self-Imposed, Master, and Cash Budgets, Flexible Budget and Variance Analysis	7	CO4
V	**Capital Structure and Valuation Basics:** Structure of Finance Function, Capital Structure Decisions, Risk and Return Concepts: Beta, Sharpe Ratio, Jensen's Alpha **Time Value of Money and Valuation:** Present Value and Future Value (Single and Multi-Period Cases), Perpetuity, Growing Perpetuity, and Annuity **Bond and Stock Valuation:** Bond Pricing, Yield to Maturity, and	6	CO5

	Zero-Coupon Bonds, Stock Valuation: Zero Growth, Constant Growth, Differential Growth		
VI	**Cost of Capital and WACC:** Capital Asset Pricing Model (CAPM) and Dividend Discount Model (DDM), Cost of Debt, Equity, and Preferred Stock, Weighted Average Cost of Capital (WACC) **Capital Investment Decisions:** Techniques: NPV, IRR, Payback Period, Comparisons Between Techniques **Dividend and Payout Policies:** Types of Payout: Regular Dividend, Stock Dividend, Stock Splits, Dividend Signaling and Real-World Implications	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Accounting: Text and Cases; Robert N Anthony, David F Hawkins and Kenneth A Merchant, McGraw Hill Education.
2. Cost Accounting; Horngren, Foster & Dattar; PHI Publication
3. Corporate Finance by Ross, Westerfield, Jaffe, Jordan and Kakani, McGraw Hill Education.

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_ec02/preview

Course Title: Entrepreneurship Development and Management												
Semester: VIII			Term: Even			Course Code: 24ILO8023B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. **To** introduce the fundamental concepts of entrepreneurship, including its types, team building, and innovation processes.
2. **To** provide exposure to case studies and real-world examples, emphasizing the transition from design to entrepreneurship.
3. **To** enable students to develop entrepreneurial skills through frameworks such as Business Model Canvas and Lean Canvas.
4. **To** guide students from ideation to proof of concept, fostering creativity and technology-led entrepreneurship.

Course Outcomes:

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

1. Understand the principles of entrepreneurship and its significance in driving innovation and business growth.
2. Analyze different types of entrepreneurship and their applications in fields like bio-med innovation and technology.
3. Develop cohesive and effective entrepreneurial teams and apply creativity to generate viable product ideas.
4. Utilize frameworks like Business Model Canvas and Lean Canvas to create structured business plans and pitches.
5. Transition from a product idea to a proof of concept, demonstrating practical entrepreneurial skills.
6. Evaluate successful start-up stories and apply their lessons to develop and pitch innovative business models.

Module	Contents	Hours	COs
I	Introduction to Entrepreneurship, What is Entrepreneurship GDC Program, Hand holding for Entrepreneurship GDC start-up stories	7	CO1
II	Entrepreneurship Types, Team Building, Innovation and Entrepreneurship, Solar Oven case-study Paradigm shift from Design to Entrepreneurship	9	CO2
III	Bio- Med Innovation and Entrepreneurship, New-age Entrepreneurship	9	CO3
IV	Business Model Canvas, Technology led Entrepreneurship	7	CO4

V	Entrepreneurship as Academic Program - IITH case study, Creativity and Generating Product Ideas, From Idea to Proof of Concept, Network Entrepreneurship	6	CO5
VI	Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 1, Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 2	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Disciplined Entrepreneurship: 24 Steps to a Successful Startup by Bill Aulet
2. The Essence of Medical Device Innovation by B Ravi
3. THE FORTUNE AT BOTTOM OF PYRAMID: Eradicating Poverty Through Profits by C. K. Prahalad Stay Hungry
4. Stay Foolish by Rashmi Bansal
5. The Entrepreneurial Connection: East Meets West in the Silicon Valley by Gurmeet Naroola
6. Innovation By Design: Lessons from Post Box Design & Development by B. K. Chakravarthy , Janaki Krishnamoorthi

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_de07/preview

Course Title: Human Resource Management												
Semester: VIII			Term: Even				Course Code: 24ILO8024B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment
Examination ESE: End Semester
Examination CA: Continuous
Assessment

Course Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations
3. To familiarize the students about the latest developments, trends & different aspects of HRM
4. To acquaint the student with the importance of inter-personal & inter-group behavioural skills in an organizational setting required for future stable engineers, leaders and managers

Course Outcomes: Learner will be able to…

1. Evaluate the concept, scope, and importance of Human Resource Management (HRM) within organizations.
2. Evaluate the impact of personality traits and perceptions on individual decision-making and behavior within organizations.
3. Create a framework for designing an effective organizational structure that aligns with the organiza- tion's goals and strategy.
4. Develop a framework for designing an effective organizational structure that aligns with the organi- zation's goals and strategy.
5. Identify the causes of diversity within organizations and evaluate the impact of diversity on employee motivation and performance.
6. Critically evaluate the key concepts and principles of Human Resource Management (HRM), including its scope, importance, and interdisciplinary nature.

Module	Contents	Hours	COs
I	**Introduction to HR** Human Resource Management- Concept, Scope and Im- portance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions Human resource development (HRD): changing role of HRM – Human resource Planning, Technologicalchange, Re- structuring. **Self-Learning:** Rightsizing, Empowerment, TQM, Managing ethical issues	8	CO1
II	**Organizational Behaviour (OB)** Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues Personality: Meaning and Determinants of Personality, Per- sonality development, Personality Types, Assessment of Per- sonality Traits for Increasing Self Awareness Perception: Attitude and Value, Effect of perception on Indi- vidual Decision- making, Attitude and Behaviour Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. **Self-Learning:** Case study	8	CO2
III	**Organizational Structure &Design** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace. **Self-Learning:** Tactics and strategies.	8	CO3
IV	**Human resource Planning** Recruitment and Selection process, Job-enrichment, Em- powerment - Job- Satisfaction, employee morale Performance Appraisal Systems: Traditional & modern meth- ods, Performance Counselling, Career Planning **Self-Learning:** Training & Development: Identification of Training Needs, Training Methods	7	CO4
V	**Emerging Trends in HR**	7	CO5

	Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people **Self-Learning:** Intra company cultural difference in employee motivation		
VI	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM:** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws.** **Self-Learning: Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	7	CO6
	Total	**45**	

St. John College of Engineering and Management
Autonomous Institute
(A Christian Religious Minority Institution)
Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE
DTE Code : 3218 AICTE Permanent ID : 1-4790201
NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

Course Title: Professional Ethics and CSR												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8025B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To understand professional ethics in business
2. To recognized corporate social responsibility

Course Outcomes: Learner will be able to…

1. Understand rights and duties of business
2. Understand professional ethics in the marketspace
3. Demonstrate professional ethics of consumer protection
4. Understand legal aspects of corporate social responsibility
5. Understand Public-Private Partnership in India
6. Analyse Corporate Social Responsibility in Globalizing India

Module	Contents	Hours	COs
I	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights **Self-Learning:** Duties of Business	8	CO1
II	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control. **Self-Learning** Ethics of Conserving Depletable Resources	8	CO2

III	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm's Duties to Con- sumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Dis- crimination; Extent of Discrimination **Self-Learning:** Reservation of Jobs.	8	CO3
IV	**Introduction to Corporate Social Responsibility:** Potential Busi- ness Benefits—Triple bottom line, Human resources, Risk manage- ment, Supplier relations; Criticisms and concerns—Nature of busi- ness; Motives; Misdirection. **Self-Learning:** Trajectory of Corporate Social Responsibility in In- dia	7	CO4
V	**Corporate Social Responsibility:** Articulation of Gandhian Trustee- ship Corporate Social Responsibility and Small and Medium Enter- prises (SMEs) in India, Corporate Social Responsibility. **Self-Learning:** Public-Private Partnership (PPP) in India	7	CO5
VI	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India. **Self-Learning:** Legal Aspects of Corporate Social Responsibility Companies Act, 2013.	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.

Text Books:

1. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Pub- lisher: Pearson, New Delhi.
2. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

Links for online NPTEL/SWAYAM courses:

1. https://onlinecourses.nptel.ac.in/noc21_mg54/preview

Course Title: Research Methodology												
Semester: VIII			Term: Even			Course Code: 24ILO8026B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives

1. To provide an understanding of the fundamentals of research, including literature surveys, experimental skills, and data analysis.
2. To equip students with the skills for effective technical writing and presentations, emphasizing clarity and precision.
3. To foster creativity and ethical awareness in the design and execution of research projects.
4. To introduce students to intellectual property concepts and department-specific research methodologies.

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

1. Conduct comprehensive literature surveys and analyze data to identify research gaps and trends.
2. Develop and execute experimental designs effectively while adhering to ethical principles.
3. Apply technical writing techniques to prepare research papers, case studies, and project reports.
4. Deliver impactful technical presentations showcasing research findings.
5. Demonstrate creativity in problem-solving and innovation within research contexts.
6. Understand and apply principles of intellectual property in protecting and commercializing research outcomes.

Module	Contents	Hours	COs
I	A group discussion on what is research; overview of research, literature survey, experimental skills	8	CO1
II	Data analysis, modelling skills; technical writing; technical presentations; creativity in research	8	CO2
III	Creativity in research; group discussion on ethics in research, design of experiments	8	CO3
IV	Intellectual property	7	CO4

V	Department-specific research discussions	7	CO5
VI	Case study/Research paper writing	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd ed), Singapore, Pearson Education

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_ge28/preview

Course Title: IPR and Patenting												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8027B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment
Examination ESE: End Semester
Examination CA: Continuous Assessment

Course Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications.

Course Outcomes: Learner will be able to…

1. Understand to Intellectual Property Rights and its importance in modern global economic environment
2. Apply Enforcement of Intellectual Property Rights
3. Understand Emerging Issues in IPR
4. Understand and apply basics of patenting
5. Understand patent rules and apply
6. Understand and implement Procedure for Filing a Patent

Module	Contents	Hours	COs
I	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Pa- tents, Trademarks, Copyrights, Industrial Designs, Plant va- riety protection, Geographical indications, Transfer of tech- nology etc. **Importance of IPR in Modern Global Economic Environ- ment:** Theories of IPR, Philosophical aspects of IPR laws **Self-Learning:** Need for IPR, IPR as an instrument of devel- opment	8	CO1
II	**Enforcement of Intellectual Property Rights:** Introduc tion, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement. **Indian Scenario of IPR:** Introduction, in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Ma- jor international treaties signed by India, Procedure for sub- mitting patent and Enforcement of IPR at national level etc. **Self-Learning:** History of IPR	8	CO2

III	**Emerging Issues in IPR:** Challenges for IP in digital econ- omy, e-commerce, human genome, biodiversity and tradi- tional knowledge etc. **Self-Learning:** Cross-border IPR Enforcement	8	CO3
IV	**Basics of Patents:** Definition of Patents, Conditions of pa- tentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Pa- tent specification Patent claims, Disclosures and non-disclo- sures, Patent rights and infringement. **Self-Learning:** Method of getting a patent	7	CO4
V	**Patent Rules:** Indian patent act, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral trea- ties where India is a member (TRIPS agreement, Paris conven- tion etc.) **Self-Learning:** European patent rules	7	CO5
VI	**Procedure for Filing a Patent (National and Interna- tional):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of pa- tent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Self-Learning: Patent databases:** Important websites, Searching international databases	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell

Text Books:

1. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
2. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company

Links for online NPTEL/SWAYAM courses:

https://onlinecourses.nptel.ac.in/noc22_hs59/preview

St. John College of Engineering and Management
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DTE Code : 3218 AICTE Permanent ID : 1-4790201
NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

Course Title: Digital Business Management												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8028B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To familiarize with digital business concept
2. To acquaint with E-commerce
3. To give insights into E-business and its strategies

Course Outcomes: Learner will be able to…

1. Identify drivers of digital business
2. Illustrate various approaches and techniques for E-business and management
3. Understand Digital Business Support services
4. Understand Managing E-Business
5. Understand E-Business Strategy
6. Materializing e-business from idea to realization

Module	Contents	Hours	COs
I	**Introduction to Digital Business-** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) **Self-Learning:** Opportunities and Challenges in Digital Business	8	CO1

II	**Overview of E-Commerce** **E-Commerce-** Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E- government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project **Self-Learning:** Legal, Ethics and Societal impacts of EC	8	CO2
III	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Self-Learning: Application Development:** Building Digital business Applications and Infrastructure	8	CO3
IV	**Managing E-Business**-Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security **Self-Learning:** Prominent Cryptographic Applications	7	CO4
V	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy **Self-Learning:** E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	7	CO5
VI	**Materializing e-business: From Idea to Realization**-Business plan preparation **Self-Learning:** Case Studies and presentations	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):
Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):
End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006

Text Books:

1. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
2. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, Springer
3. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan

Links for online NPTEL/SWAYAM courses:

https://onlinecourses.nptel.ac.in/noc19_mg54/preview

Course Title: Environmental Management												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8029B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral / Pract / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment

Course Objectives:

1. To introduce Environmental Management and EIA concepts, including legal and regulatory frameworks.
2. To understand EIA procedures like scoping, screening, and baseline studies.
3. To explore EIA methodologies, tools, and techniques.
4. To highlight public involvement, impact mitigation, and EMP preparation.
5. To develop skills in EIA reporting, decision-making, and implementation through case studies.

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

1. Explain the significance of Environmental Management and EIA in sustainability.
2. Conduct scoping, screening, and baseline assessments.
3. Apply EIA methodologies and tools effectively.
4. Propose mitigation strategies and prepare EMPs.
5. Evaluate EIA reports and ensure compliance.
6. Implement and follow up on EIA processes using case-based insights.

Module	Contents	Hours	COs
I	Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework	7	CO1
II	EIA Procedure - Scoping & Screening and Establishing Baseline Conditions, EIA Methodologies	8	CO2
III	Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem, EIA Methods, Tools and Techniques	8	CO3
IV	Public Involvement in EIA , Impact Management - Mitigation & Preparation of Environment Management Plans (EMP)	8	CO4
V	EIA Reporting & Review of EIA Quality, Decision Making & Project Management	7	CO5
VI	Implementation & follow up, EIA Case Examples	7	CO6
	Total	**45**	

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three course outcomes (COs), and IAE 2 will cover the remaining three course outcomes (COs). Each test will have a duration of one hour.

B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Wathern P., "Environmental Impact Assessment: Theory and Practice", Routledge Publishers, 1990
2. Marriott B., "Environmental Impact Assessment: A Practical Guide", McGraw-Hill Publication, 1997
3. Shrivastava A.K., Baxter Nicola, Grimm Jacob, "Environmental Impact Assessment", APH Publishers, 2003
4. Anjaneyulu Y., Manickam Valli, "Environmental Impact Assessment Methodologies", CRC Press, 2011
5. Glasson J., Therivel Riki, Chadwick Andrew, "Introduction to Environmental Impact Assessment", Oxford Brookes University 2012 (4th edition).

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_ar03/preview

Course Title: Industry Certification												
Semester: VIII			Term: Even			Course Code: 24AIMLVSE801B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credits	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	-	-	-	1	1	-	-	-	-	25	25

Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

Course Objectives: The objectives of this course are to
1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

Course Outcomes: After completion of this course, students will be able to
1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

Certification GUIDELINES:
The general procedure for organizing certification courses is as follows:

1. **Identification of Industry Partners**
   Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.
2. **Selection of Certification Domain**
   Students can choose two domains of their interest for the certification course and express their willing- ness to pursue the certification.
   Following combination of domains are offered in the even semesters:

	Domain 1	Domain 2
Track 1	SQL	.NET
Track 2	CCNA	AI-IBM
Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works

Track 5	Data Science	Prompt Engineering and AI
Track 6	MernStack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IoT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MernStack
Track 13	Microsoft Tools	AI-IBM
Track 14	Augmented Reality	Virtual Reality
Track 15	Professional Edge Training (PET)	

3. **Allocation of Tracks**
   Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.
4. **Course Duration**
   Students have to complete the certification course, which has a minimum duration of 30 hours.
5. **Oral & Practical Exam**
   Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

Note: A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.

Course Title: Major Project II												
Semester: VIII			**Term: Even**				**Course Code: 24AIMLPRJ801B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR/TU**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	**-**	**10**	**-**	**-**	**5**	**5**	**-**	**-**	**-**	**75**	**50**	**125**

IAE: Internal Assessment Examination ESE:
End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Objectives: The course aims:

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.
5. To develop an attitude of lifelong learning and teamwork through collaborative problem solving.
6. To inculcate project planning, execution, and management skills during project work.

Course Outcomes: After successful completion of the course students will be able to:

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group
3. Draw the proper inferences from available results through theoretical/ experimental/simulations
4. Analyse the impact of solutions in societal and environmental context for sustainable development.
5. Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
6. Demonstrate project management principles during project work.

1. Guidelines:

- Internal guide has to keep track of the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks.

2. Project Report Format:

- At the end of semester, each group needs to prepare a project report as per the guidelines issued by the University of Mumbai. Report should be submitted in hardcopy. Also, each group should submit softcopy of the report along with project documentation, implementation code, required utilities, software and user Manuals.

A project report should preferably contain at least following details:

- Abstract
- Introduction
- Literature Survey/ Existing system
- Limitation Existing system or research gap
- Problem Statement and Objective
- Proposed System
  - Analysis/Framework/ Algorithm

- Design details
- Methodology (your approach to solve the problem) Proposed System

- Experimental Setup
  - Details of Database or details about input to systems or selected data Performance Evaluation Parameters (for Validation)
  - Software and Hardware Setup
- Results and Discussion
- Conclusion and Future Work
- References
- Appendix: List of Publications or certificates

3. Desirables:

- Students should be encouraged
  - to participate in various project competition.
  - to write minimum one technical paper & publish in good journal.
  - to participate in national / international conference.

4. Continuous Assessment (CA):

- Distribution of marks for term work shall be done based on following:
  - Weekly Log Report
  - Completeness of the project and Project Work Contribution
  - Project Report (Black Book) (both side print)
  - Term End Presentation (Internal)
- The final certification and acceptance of term work ensures the satisfactory performance on the above aspects.

5. Oral & Practical:

- Oral &Practical examination (Final Project Evaluation) of Major Project 2 should be conducted by Internal and External examiners approved by University of Mumbai at the end of the semester.

6. Suggested quality evaluation parameters are as follows:

- Relevance to the specialization / industrial trends
- Modern tools used
- Innovation
- Quality of work and completeness of the project
- Validation of results
- Impact and business value
- Quality of written and oral presentation
- Individual as well as teamwork