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: 2024-2025**
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 172, 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-24 curriculum will be implemented for Artificial Intelligence and Machine Learning from the academic year 2024-25.

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.

Dr.Amruta Mhatre
BoS Chairman

Dr. Kaml shah
Principal

Bachelor of Engineering

in

Artificial Intelligence and Machine Learning

Second Year

Semester – III

SJCEM R–24 (SCHEME 'B')

Effective from Academic Year 2025-26

Program Structure for Second Year Artificial Intelligence and Machine Learning

(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24AIMLPCC301B	PCC	Discrete Mathematics	3	1	-	3	1	-	4
24AIMLPCC302B	PCC	Data Structures	3	-	2	3	-	1	4
24AIMLPCC303B	PCC	Microprocessor and Computer Architecture	3	-	2	3	-	1	4
24AIMLPCC304B	PCC	Database Management System	3	-	2	3	-	1	4
24AIMLPCC305B	PCC	Programming Language I (Python)	1	-	2	1	-	1	2
24AIMLVEC301B	VEC	Universal Human Values	2	1	-	2	1	-	3
24AIMLAEC301B	AEC	Basic Communication Skills - II	-	1	-	-	1	-	1
		Total	**15**	**3**	**8**	**15**	**3**	**5**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24AIMLPCC301B	PCC	Discrete Mathematics	20	20	60	25	-	125
24AIMLPCC302B	PCC	Data Structures	20	20	60	25	25	150
24AIMLPCC303B	PCC	Microprocessor and Computer Architecture	20	20	60	25	-	125
24AIMLPCC304B	PCC	Database Management System	20	20	60	25	25	150
24AIMLPCC305B	PCC	Programming Language II (Python)	10	10	30	50	25	125
24AIMLVEC301B	VEC	Universal Human Values	10	10	30	25	-	75
24AIMLAEC301B	AEC	Basic Communication Skills - II	-	-	-	25	-	25
		Total	**100**	**100**	**300**	**200**	**75**	**775**

Syllabus for

Second

Year

Artificial Intelligence and Machine Learning

Semester – III

SJCEM R–24(Scheme –B)

(With Effect from 2025-2026)

Course Title: Discrete Mathematics												
Semester: III			**Term:** Odd				**Course Code:** 24AIMLPCC301B					
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	1	-	3	1	-	4	20	20	60	25	-	125

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

Course Objectives: The course is aimed

1. To Cultivate clear thinking and creative problem solving.
2. To define functions and distinguish between functions and relations.
3. Define partial order relations and lattices, and understand their properties.
4. Define orthogonal sets and orthonormal bases and understand their importance in applications such as signal processing and linear algebra.
5. To study the Matrix algebra and its application in Engineering Problems.
6. To understand the concept of Fourier Series and enhance the problem solving skills.

Course Outcomes:

After completion of the course, learner will be able to:

1. Understand the notion of mathematical thinking, mathematical proofs and to **apply** them in problem solving.
2. **Define** and differentiate between relations and functions, and identify different types of functions.
3. **Apply** concepts of lattices to solve problems in various areas, such as discrete mathematics, computer science, and order theory.
4. **Define** the inner product of vectors, orthogonal bases.
5. **Apply** the concepts of eigenvalues and eigenvectors to solve engineering problems.
6. **Demonstrate** the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.

Module	Contents	Hours	COs
I	**Logic** Propositional Logic, Predicate Logic, Laws of Logic, Duality, Quantifiers, Binary Predicates, Mathematical Induction. **Self-learning Topics:** Normal Forms, Inference Theory of Predicate Calculus	7	CO1
II	**Relations and Functions** Basic concepts of Set Theory, **Relations:** Definition, Types of Relations, Representation of Relations, Closures of Relations, Warshall's algorithm, Equivalence relations and Equivalence Classes. **Functions:** Definition, Types of functions, Composition of functions, Identity and Inverse function	8	CO2

	Self-learning Topics: Operations on Relations- complementary relation, Inverse relation, Intersection and Union		
III	**Posets and Lattice** Partial Order Relations, Poset, Supremum and Infimum, Hasse Diagram, Lattice, Types of Lattice- Sub -lattice, Distributive lattice. **Self-learning Topics:** Dual of Poset, Dual in a Lattice, Bounded lattice, Complemented lattice	8	CO3
IV	**Linear Algebra-I** Vector Arithmetic, Norm, Euclidean Inner Product, Unit vector, Angle between two vectors, Cauchy-Schwarz Inequality, Orthogonality, Orthogonal Set, Orthonormal set, Gram-Schmidt Process **Self-learning Topics:** Orthogonal Projection	7	CO4
V	**Linear Algebra-II** Characteristic Equation, Eigenvalues and Eigenvectors and properties (without proof), Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials, Similarity of matrices, diagonalizable and non-diagonalizable matrices **Self-learning Topics:** Derogatory and non-derogatory matrices, Functions of Square Matrix, Linear Transformations, Quadratic forms.	8	CO5
VI	**Fourier Series** Dirichlet's conditions, Definition of Fourier series, Fourier series of periodic functions with period 2 and 2l, Fourier series of even and odd functions, Half range Sine and Cosine Series. **Self-learning Topics:** Parseval's Identity, Complex form of Fourier Series, orthogonal and orthonormal set of functions, Fourier Transform.	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.

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. Advanced Engineering Mathematics, C. Ray Wylie, Louis C. Barrett, McGraw-Hill Book Co., New York, 6th Edition.
2. Y N Singh, "Discrete Mathematical Structures", Wiley-India

Text Books:

1. Higher Engineering Mathematics, Dr. B .S. Grewal, Khanna Publication, 44th Edition.
2. Linear Algebra & its applications, David C. Lay, Pearson Publication, 3rd Edition.
3. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman, "Discrete Mathematical Structures", Pearson Education.

Useful Links

https://www.edx.org/learn/discrete-mathematics

1. https://www.coursera.org/specializations/discrete-mathematics
2. https://nptel.ac.in/courses/106/106/106106094/

Course Title: Data Structures													
Semester: III			**Term:** Odd				**Course Code:** 24AIMLPCC302B						
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	--	02	03	--	01	04	20	2	0	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 standard and abstract data representation methods.
2. To acquaint with the structural constraints and advantages in usage of the data.
3. To understand the memory requirement for various data structures.
4. To operate on the various structured data.
5. To understand various data searching and sorting methods with pros and cons.
6. To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

At the end of the course students will be able:

1. To implement Linear and Non-Linear data structures and explain various data structures related terminologies and its types.
2. To design the algorithms using stacks and queues to solve the programming problems.
3. To choose appropriate data structure in linked list and apply it to solve problems in various domains.
4. To describe and apply operations like insertion, deletion, searching and traversing on tree data structure.
5. To describe and apply operations like insertion, deletion, searching and traversing on graph data structure..
6. To select appropriate searching and/or sorting techniques in the application development

Prerequisite: Basic Programming syntax of C. Functions in C. Pointers in C, dynamic memory allocation, pointer to pointe, pointer to functions.

Module	Contents	Hours	COs
I	**Introduction to Data Structures:** Concept of ADT, Types of Data Structures- Linear and Nonlinear, Operations on Data Structures. Arrays, Multidimensional Arrays, Array of Pointers, String Manipulation. **Self-learning Topics:** Structures with pointers	10	CO1
II	**Stack and Queues:** **Stack:** Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion. **Queue:** Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Introduction of Double Ended Queue, Applications of Queue.	8	CO2

	Self-learning Topics: Implementation of stack and queue using structure		
III	**Linked List:** Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List, Singly Linked List Application-Polynomial Representation and Addition. **Self-learning Topics:** Singly Linked List Application-Polynomial Representation and Addition	8	CO3
IV	**Trees:** Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding, Search Trees-AVL, rotations in AVL Tree, operations on AVL Tree, Introduction of B Tree, B+ Tree. **Self-learning Topics:** Red-Black trees	7	CO4
V	**Graphs:** Introduction, Graph Terminologies, Representation of Graph, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS), Graph Application-Topological Sorting. **Self-learning Topics:** Graph Application- Topological Sorting.	7	CO5
VI	**Searching and Sorting Techniques:** **Searching Techniques:** Linear Search, Binary Search, Hashing-Concept, Hash Functions, Collision resolution Techniques. **Self-learning Topics:** Merge sort and quick sort.	5	CO6
	Total	45	

Exp. No.	List of Experiments	COs
1	Implement Stack ADT using array.	CO1, CO2
2	Convert an Infix expression to Postfix expression using stack ADT.	CO2
3	Evaluate Postfix Expression using Stack ADT.	CO2
4	Implement Linear Queue ADT using array.	CO2
5	Implement Circular Queue ADT using array.	CO2
6	Implement Priority Queue ADT using array.	CO2
7	Implement Singly Linked List ADT.	CO3
8	Implement Circular Linked List ADT.	CO3
9	Implement Doubly Linked List ADT.	CO3
10 I	mplement Stack / Linear Queue ADT using Linked List.	CO3
11*	Implement Binary Search Tree ADT using Linked List.	CO4
12*	Implement Graph Traversal techniques: a) Depth First Search b) Breadth First Search	CO5

13	Applications of Binary Search Technique.	CO6
14	Implement of Selection and Bubble Sort	CO6
15	Implement of Merge / Quick Sort	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. Rajesh K Shukla, "Data Structures using C and C++", Wiley-India
2. Βαλαγυρυσαμψ, "Δατα Στρυχτυρε Υσινγ Χ", Τατα ΜχΓραω–Ηιλλ Εδυχατιον Ινδια.

Text Books:

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw- Hill
3. Higher Education
    1. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2ndEdition, CENGAGE Learning.
    2. Data Structures Using C, ISRD Group, 2ndEdition, Tata McGraw-Hill.

Useful Links

1. https://swayam.gov.in/nd1_noc19_cs67/preview
2. https://nptel.ac.in/courses/106/102/106102064/
3. https://www.edx.org/course/data-structures-fundamentals

Course Title: Microprocessor and Computer Architecture												
Semester: III			**Term:** ODD				**Course Code:** 24AIMLPCC303B					
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	-	125

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

Course Objectives:

1. To conceptualize the basics of organizational and features of a digital computer.
2. To study microprocessor architecture and assembly language programming.
3. To equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors.
4. To emphasize on instruction set and logic to build assembly language programs.
5. To prepare students for higher processor architectures and embedded systems.

Course Outcomes:

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

1. Describe basic organization of computer and the architecture of 8086 microprocessor and implement assembly language programming for 8086 microprocessors.
2. Describe different control unit design methods and conceptualize instruction level parallelism.
3. Describe core concepts of 8086 microprocessor.
4. Identify the specifications of peripheral chip.
5. Design 8086 based system using memory and peripheral chips and Explain the architecture of advanced processors.
6. Describe hyper threading technology.

Module	Contents	Hours	COs
I	**Overview of Computer architecture and Organization**	**5**	CO1
	Introduction of Computer Organization and Architecture, Von Neumann Model, Performance Measure of Computer Architecture. Architecture of 8086 Family, Instruction Set, Addressing Modes. **Self-learning Topics:** Basic Organization of Computer and Block Level Description of the Functional Units, Evolution of Computers		

II	**Processor organization and architecture**	7	CO2
	CPU Architecture, Instruction Formats, Basic Instruction Cycle with Interrupt Processing. Control Unit: Soft Wired (Microprogrammed) and Hardwired Control Unit. Microinstruction Sequencing and Execution, Micro Operations, Introduction to Parallel Processing Concepts, Flynn's Classifications, Instruction Pipelining, Pipeline Hazards. **Self-learning Topics :**Instruction Interpretation and Sequencing, Concepts of Nano Programming.		
III	**The Intel microprocessors 8086 architecture**	8	CO3
	8086CPU Architecture, Programmer's Model, Functional Pin Diagram. Memory Segmentation, Banking in 8086, Functioning of 8086 in Minimum mode and Maximum mode. Timing diagrams for Read and Write operations in minimum and maximum mode. **Self-learning Topics: D e** -multiplexing of Address/Data bus**,** Interrupt structure and its servicing.		
IV	**Memory and peripherals Interfacing**	10	CO4
	Memory Interfacing - RAM and ROM Decoding, 8255-PPI-Block diagram, CWR, operating modes, interfacing with 8086. 8257-DMAC-Block diagram, DMA operations and transfer modes. Programmable Interrupt Controller 8259-Block Diagram. **Self-learning Topics:** Techniques Partial and Absolute ,Interfacing the 8259 in single and cascaded mode.		
V	**80386Dx processor and Pentium processor**	10	CO5
	Architecture of 80386 microprocessor. 80386 registers-General purpose Registers, EFLAGS and Control registers. Real mode, Protected mode, virtual 8086 mode. Pentium Architecture, Superscalar Operation, Integer &Floating-Point. Pipeline Stages, Branch Prediction Logic. **Self-learning Topics:** 80386 memory management in Protected Mode – Descriptors and selectors, descriptor tables, the memory paging mechanism, Cache Organization and MESI protocol.		
VI	**Pentium 4 and ARM processor**	5	CO6
	Comparative study of 8086, 80386, Pentium 1, Pentium II and Pentium. Pentium 4: Net burst micro architecture. Instruction translation look aside buffer and branch prediction, Hyper threading technology and its use in Pentium 4, Recap of modules, Outcomes, Applications and summarization. **Self-learning Topics:** Application and Features of ARM processors**.**		
	Total	45	

Exp. No.	List of Experiments	COs
1	Use of programming tools (Debug/TASM/MASM/8086kit) to perform basic arithmetic operations on 8-bit/16-bit data.	CO1
2	Assembly programming for 16-bit addition, subtraction, multiplication and division (menu based)	CO1, CO2
3	Assembly program based on string instructions (overlapping/non-overlapping block transfer/ string search/ string length).	CO1, CO2
4	Assembly program to display the contents of the flag register.	CO2, CO3
5	Any Mixed Language programs.	CO2, CO3
6	Assembly program to sort numbers in ascending/ descending order.	CO3, CO4
7	Assembly program to find minimum/maximum number from a given array.	CO3, CO4
8	Assembly program using macro.	CO4, CO5
9	Program and interfacing using 8255.	CO5, CO6
10	Program and interfacing of ADC/DAC/ Stepper motor.	CO5, CO6

Evaluation and Assessment Scheme:

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B. End Semester Theory Examination (ESE):

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C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

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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. B. Govindarajulu, Computer Architecture and Organization: Design Principles and Applications**.**
2. Barry B. Brey, "Intel Microprocessors", 8th Edition, Pearson Education India.
3. James Antonakons, "The Pentium Microprocessor", Pearson Education
4. Douglas Hall, "Microprocessor and Interfacing", Tata McGraw Hill.

Text Books:

1. I. C. Hamacher, Z. Vranesic and S. Zaky, Computer Organization, McGraw Hill.
2. W. Stallings, Computer Organization and Architecture: Designing for Performance, Pearson
3. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI
4. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer System: The 8086/8088 Family, Architecture, Programming and Design", Prentice Hall
5. Walter A. Triebel, "The 80386DX Microprocessor: hardware, Software and Interfacing", Prentice Hall
6. Tom Shanley and Don Anderson, "Pentium Processor System. Architecture", Addison- Wesley.

Useful Links

1. https://nptel.ac.in/courses/106/105/106105163/
2. https://www.udemy.com/course/computer-organization-and-architecture-j/
3. https://nptel.ac.in/courses/108/105/108105102/
4. https://www.mooc-list.com/tags/microprocessors

Course Title: Database Management System													
Semester: III			**Term:** Odd				**Course Code:** 24AIMLPCC304B						
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**								
2	--	2	2	--	1	3	20	2	20	60	25	25	150

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

Course Objectives:

- To learn the basics and understand the need of database management system.
- To construct conceptual data model for real world applications
- To Build Relational Model from ER
- To introduce the concept of SQL to store and retrieve data efficiently Using Query Optimization Techniques.
- To demonstrate notions of normalization for database design.
- To understand the concepts of transaction processing- concurrency control & recovery procedures.

Course Outcomes:

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

1. Recognise the need of a database management system and Design ER model for real life examples.
2. Understand relational algebra operations and write relational algebra queries
3. Formulate SQL queries by understanding various commands in SQL.
4. Apply the concept of normalization to relational database design
5. To generate the set of query plan that can be optimal for each possible combination of parameter values and user preferences
6. Describe the concept of transaction, concurrency and recovery.

Module	Contents	Hours	COs
I	**Database System Architecture and Entity Relationship Model** : Database Management System Architecture , Data Abstraction and Data Independence , Entity Relationship Model : Entity Types , Entity Sets , Attributes and Keys , Relationship Types , Relationship Sets. Converting Entity Relational Model to Tables (Relational Database) **Self-Learning**: Object Relational Database Management System (ORDBMS).	8	CO1
II	**Relational Algebra:** Selection Operation, Projection Operation, Union Operation, Intersection Operation, Cartesian Operation and Join Operation **Self-Learning**: Relational Calculus.	8	O2

III	**Structured Query Language (SQL)**: SQL Standards, Data Definition Commands, Set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Complex Retrieval Queries using Group By, Recursive Queries, and nested Queries. **Self-Learning**: Triggers, Procedures, Functions and Packages. Embedded SQL.	8	CO3
IV	**Relational Database Design**: 1NF, 2NF, 3NF, BCNF, Algorithm for Decomposition Using functional Dependencies, Decomposition Using Multivalued Attribute. **Self-Learning**: NoSQL Data Models.	8	CO4
V	**Query Processing and Optimization**: Query Optimization: Transformation Of Relational Expression, Estimating Statistics Of Expression Result, Choice Of Evaluation Plan. Transaction Concept, ACID Properties, Serializability, Lock Based Protocols, Multiple Granularity, Insertion-Deletion and Predicate Reads, Timestamp Based Protocols, Validation Base Protocols, Log Based Recovery **Self-Learning** : Distributed Transactions and TCL , Performance Tuning	9	CO5
VI	**Foundations of IBM Db2 :** Introduction, Features, Editions, Industry Use Cases, Comparison with Other RDBMS, Db2 Installation and Interface System Requirements, Installation, CLP, IBM Data Studio, Db2 Web Console, Basic SQL Operations in Db2 CREATE, INSERT, UPDATE, DELETE, SELECT, Constraints, NULL Handling, Joins **Self-Learning:.** Db2 on Cloud, Backup & Recovery, Indexing & Performance Tuning, Distributed Databases, Db2 Warehouse on Cloud	4	CO6
	Total	45	

Exp. No.	List of Experiments	COs
1	Entity Relational Model Reduction to Relational Schema (Use DDL Commands)	CO1
2	Alter – Insert Commands on Database Designed in Experiment – 01	CO1, CO2
3	Select Commands on Database Designed in Experiment – 01	CO1. CO2
4	Select Commands on Database Designed in Experiment – 01	CO2, CO3
5	Update – Delete Commands on Database Designed in Experiment – 01	CO3, CO4
6	Query Optimization of Experiment No: 3 & 4	CO3. CO4
7	Mini Project: Define Problem Statement, Construct ER – Diagram and Reduce ER-Diagram to Relation Database Schema.	CO4, CO5
8	Mini Project: Use 1NF, 2NF and 3NF on Relational Database Designed in Experiment No: 7	CO4, CO5

9	Mini Project: Design Front End or Text Based Interface Using and Programing Language like Python, Java, .Net etc.	CO5, CO6
10	Mini Project: Generate Data Reports in HTML, Text File or any Other reporting tool Like Crystal Reports etc.	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:

- Elmasri and Navathe, Fundamentals of Database Systems, 6th Edition, Pearson education.
- Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill.

Text Books:

1. An Introduction to Database System by C. J. Date Sixth Edition.
2. Database Systems The Complete Book By Jeffery D. Ullman Second Edition.

Useful Links

1. https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/
2. **https://www.youtube.com/playlist?list=PL9ysvtVnryGpnIj9rcIqNDxakUn6v72Hm**

Course Title: Programming Language I(Python)												
Semester: III			**Term:** ODD				**Course Code:** 24AIMLPCC305B					
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**							
1	-	2	1	-	2	3	10	10	30	50	25	125

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

Course Objectives:

1. To learn the basic concepts of object-oriented programming (OOP).
2. To understand advanced features of OOP using C++.
3. To study various concepts of Java programming.
4. To differentiate between C++ and Java programming.
5. To write error free programs.
6. To apply concepts of OOP to solve real world problems.

Course Outcomes:

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

1. Illustrate basic concepts of object oriented programming (OOP).
2. Apply OOP concepts to solve real life problems.
3. Design applications using advanced concepts of OOP.
4. Design reusable code using inheritance, package etc. in Java.
5. Design programs to handle exceptions and parallel execution.
6. Develop GUI based applications.

Prerequisite: Basic programming syntax of C Programming**,** Concepts of local and global variables**,** Structure and Union

Module	Contents	Hours	COs
I	Basics of Python: Introduction, Basic & Built-in Math functions, Basic data types (Numeric, Boolean, Compound), Quotes, print() function, range() function, Tuples, Lists, Dictionaries, Sets, Numpy Arrays, Strings. **Self-Learning Topics**: Practical applications with combined data types.	2	CO1
II	Control Statements and Function: Control flow statements: Conditional statements (if, if…else, nested if), Looping in Python (while loop, for loop, nested loops), Built-in functions in python, Defining a Function, Checking & Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Recursive functions, Anonymous Functions (Lambda, Map, Reduce, Filter). **Self-Learning Topics**: Zip() function, Function decorators	3	C02

III	Object Oriented Programming: Creating Classes and Objects, Self-Variable, Constructors, Inheritance, Polymorphism. **Self-Learning Topics**: Exceptions Handling, User Defined Exceptions.	3	CO3
IV	Modules and Packages: Importing own module as well as external modules, Understanding Packages, modules and external packages, Opening and Reading Files and Folders (Python OS Module, Python Datetime Module, Python Math and Random Modules). **Self-Learning Topics**: Regular expression in python, Text Processing.	2	CO4
V	GUI Programming with Database Connectivity: GUI Programming Toolkits, Creating GUI Widgets with Tkinter, Creating Layouts, Form Components, Dialog Boxes. Types of Databases used with Python, Mysql database Connectivity with Python, Performing DML operations on database. **Self-Learning Topics**: File handling, Pickle in Python.	3	CO5
VI	Advanced Python: Emails with Python: Introduction to Emails with Python, Sending Emails with Python, Receiving Emails with Python. **Self-Learning Topics**: Networking in Python: Client-Server socket programming.	2	CO6
	Total	**15**	

Exp. No.	List of Experiments	COs
1	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.	CO1
2	Write a Python program to implement Basic String Operations & String Methods.	CO1
3	Write a Python program to implement functions of List, Tuples, Dictionaries.	CO1
4	Write a Python program to implement Arrays / Numpy Array (1D, 2D) applications.	CO1
5	Write python programs to demonstrate applications of different decision-making statements. CO2	CO2
6	Write a Python program to implement Functions and Recursion.	CO2
7	Write a Python program to implement Programs based on Lambda, Map, Reduce Functions.	CO2
8	Write python programs to implement Classes & objects, Constructors.	CO3
9	Write python programs to implement Inheritance & Polymorphism.	CO3
10	Write python programs to create user-defined modules/packages and import them in a program.	CO4
11	Write python programs to understand GUI designing and database operations (Programs based on GUI designing using Tkinter, Mysql database creation & Database connectivity with DML).	CO5
12	Write python program to implement sending automated emails with Python.	CO6

Reference Books:

1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
2. Martin C. Brown," Python: The Complete Reference", McGraw-Hill Publication.
3. Paul Barry," Head First Python", 2nd Edition, O'Reilly Media, Inc.

Text Books:

1. Dr. R. Nageswara Rao," Core Python Programming" , Dreamtech Press, Wiley Publication
2. M. T. Savaliya , R. K. Maurya, "Programming through Python", StarEdu Solutions.
3. E Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Publication.

Useful Links:

1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview
2. http://docs.python.org/release/3.0.1/tutorial/
3. http://spoken-tutorial.org
4. www.staredusolutions.org
5. https://www.tutorialspoint.com/python/index.htm

Course Title: Universal Human Values												
Semester: III			**Term:** Odd				**Course Code:** 24AIMLVEC301B					
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**							
2	1	-	2	1	-	3	10	10	30	25	-	75

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

Course Objectives:

1. To become more aware of themselves, and their surroundings (family, society, nature).
2. To gain clarity about the basic human aspirations of happiness and prosperity, and understand the role of right understanding, human relationships, and physical facilities in fulfilling them.
3. To become more responsible in life, especially in addressing day-to-day challenges by seeking sustainable and human-centered solutions.
4. To recognize and reflect on their role in human relationships, and respond with sensitivity, trust, and mutual respect in their personal and social life.
5. To become sensitive to their commitment towards what they have understood, including universal human values, harmony in relationships, and contribution to a just and humane society.
6. To apply the understanding of values and harmony in real-life situations within the self, family, society, and nature, thus making a conscious beginning towards value-based living.

Course Outcomes:

At the end of the course students will be able:

1. TExplain the interdependence between 'Values' and 'Skills' in ensuring sustained happiness and prosperity, which are the core aspirations of all human beings.
2. Develop a holistic perspective among students towards life and profession through a correct understanding of the human reality as the coexistence of self and body.
3. Understand the foundational values of trust and respect in human relationships and their role in achieving happiness and prosperity in family and society.
4. Apply the understanding of harmony and co-existence in nature to develop a holistic perception of existence.
5. Demonstrate ethical human conduct and natural acceptance of human values based on holistic understanding.
6. Demonstrate trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature and profession based on a value-based approach.

Module	Contents	Hours	COs
I	**Introduction to Value Education**	**6**	
	• Understanding Value Education • Self-exploration as the Process for Value Education- Continuous Happiness and Prosperity – the Basic Human Aspirations • Right Understanding, Relationship and Physical Facility • Happiness and Prosperity – Current Scenario • Method to Fulfil the Basic Human Aspirations		CO1
II	**Harmony in the Human Being**	**6**	
	• Understanding Human being as the Co-existence of the Self and the Body • Distinguishing between the Needs of the Self and the Body • The Body as an Instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to Ensure self-regulation and Health		CO2
III	**Harmony in the Family and Society**	**6**	
	• Harmony in the Family – the Basic Unit of Human Interaction • Values in Human-to-Human Relationship • 'Trust' – the Foundational Value in Relationship • 'Respect' – as the Right Evaluation • Understanding Harmony in the Society • Vision for the Universal Human Order		CO3
IV	**Harmony in the Nature (Existence)**	**5**	
	• Understanding Harmony in the Nature • Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature • Realizing Existence as Co-existence at All Levels • The Holistic Perception of Harmony in Existence		CO4
V	**Implications of the Holistic Understanding**	**4**	
	• Natural access acceptance of Human Values • Definitiveness of (Ethical) Human Conduct • A Basis for Humanistic Education, • Humanistic Constitution and Universal Human Order		CO5
VI	**Professional Ethics**	**3**	
	• Competence in Professional Ethics • Holistic Technologies, Production Systems and Management Models-Typical Case Studies • Strategies for Transition towards Value-based Life and Profession		CO6
	Total	**30**	

List of Tutorials

Sr. No.	Topics	Hrs.	COs
1	Sharing about oneself	1	CO1
2	Exploring human consciousness	1	CO1
3	Exploring natural acceptance	1	CO1
4	Exploring the difference of needs of self and body	1	CO2
5	Exploring sources of imagination in the self	1	CO2
6	Exploring harmony of self with the body	1	CO2
7	Exploring the feeling of trust	1	CO3
8	Exploring the feeling of respect	1	CO3
9	Exploring systems to fulfill human goal	1	CO4
10	Exploring the four orders of nature	1	CO4
11	Exploring coexistence in existence	1	CO5
12	Exploring ethical human conduct	1	CO5
13	Exploring humanistic models in education	1	CO6
14	Exploring steps of transition towards universal human order	1	CO6
	Total Hours	**14**	

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. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R Gaur, R Asthana, G P Bagaria, 2 nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 53-2

Useful Links:

1. https://www.youtube.com/@UniversalHumanValues

Course Title: Basic Communication Skills - II (BCS - II)												
Semester: III			**Term:** Odd				**Course Code:** 24AIMLAEC301B					
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**							
--	01	--	--	01	--	01	--	--	--	25	--	25

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

Course Objectives:

1. To train students on grooming and their all-round development.
2. To instill confidence amongst learners about interviewing influential personnels.

Course Outcomes:

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

1. Understand and demonstrate improved formal dressing and appearance.
2. Apply ideas, ask insightful questions and build connections through interview experiences.
3. Develop required vocabulary and updated knowledge of the current affairs at a global level.
4. Apply ethical behavioural skills at both academic as well as in professional life.

Tut. No.	List of Tutorials	Hours	COs
	Speaking Skills		
1.	Role Play	01	CO1
2.	Poster Presentation (Group): Assignment 5	01	CO1
3.	Interviewing an influential person with Jeo tag photo or video: Assignment 8	01	CO2
4.	Story Telling with moral/value	01	CO1
5.	Impromptu	01	CO3
	Reading Skills		
6.	Summarization – unseen passage Assignment 2	01	--
7.	Book Review Presentation: Assignment 4	01	CO1
8.	Reading Newspaper Article	01	--
	Writing Skills		
9.	Vocabulary Building: Crossword	01	CO3
10.	One Word Substitution, Collocation, Phrases & Idioms -Assignment 1	01	CO3
11.	Expansion of an Idea- Assignment 3	01	CO3

12.	Behavioural Ethics: Ethical Code of Conduct: Assignment 6	01	CO4
13.	Dress & Appearance: Assignment 7	01	CO1
14.	Paragraph Writing	01	--
15.	Dialogue Writing (Formal)	01	--

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. 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

Bachelor of Engineering in
Artificial Intelligence and Machine Learning

Third Year
Semester – V

SJCEM R–24 (Scheme-B)

Effective from Academic Year 2025-26

Program Structure for Third Year Artificial Intelligence and Machine Learning
(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24AIMLPCC501B	PCC	Web Computing	3	-	2	3	-	1	4
24AIMLPCC502B	PCC	Artificial Intelligence	3	-	2	3	-	1	4
24AIMLPEC501XB	PCC	Professional Elective I	3	-	2	3	-	1	4
24AIMLPEC502XB	PEC	Professional Elective II	3	-	2	3	-	1	4
24AIMLOEE501XB	AEC	Open Elective I	3	-	-	3	-	-	3
24AIMLVSEC501B	VSEC	Employability Enhancement Program -5 (EEP 5)	1	-	4	-	-	2	3
		Total	**16**	**0**	**12**	**16**	**0**	**6**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24AIMLPCC501B	PCC	Web Computing	20	20	60	25	-	125
24AIMLPCC502B	PCC	Artificial Intelligence	20	20	60	25	25	150
24AIMLPEC501XB	PCC	Professional Elective I	20	20	60	25	25	150
24AIMLPEC502XB	PEC	Professional Elective II	20	20	60	-	-	150
24AIMLOE501XB	AEC	Open Elective I	20	20	60	-	-	100
24AIMLVSEC501XB	VSEC	Employability Enhancement Program -5 (EEP 5)	-	-	-	25	-	25
		Total	**100**	**100**	**300**	**125**	**75**	**700**

Program Structure for Third Year Artificial Intelligence and Machine Learning

Program Electives Courses

Semester Sem V	**Professional Elective I**	
	Track 01	Track 02
	Computational Operation	Operational Security
	Agile & Project Management	**Information & Network Security**
Semester Sem V	**Professional Elective II**	
	Track 03	Track 04
	Data Engineering	Advances Artificial intelligences
	Data Engineering for BI	**AI & ML For Health & Social Carfe**

Syllabus for

Third Year

Artificial Intelligence and Machine Learning

Semester – V

SJCEM R–24(Scheme-B)

(With Effect from 2025-2026)

Course Title: Web Computing												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCC501B					
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	-	125

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

Course Objectives:

1. To orient students to Web Programming fundamental
2. To expose students to JavaScript to develop interactive web page development
3. To orient students to Basics of REACT along with installation
4. To expose students to node.js applications using express framework
5. To orient students to Fundamentals of node.js
6. To expose students to Advanced concepts in REACT

Course Outcomes:

1. Select protocols or technologies required for various web applications
2. Apply JavaScript to add functionality to web pages.
3. Design front end application using basic React.
4. Construct web based Node.js applications using Express
5. Design front end applications using functional components of React.
6. Design back-end applications using Node.js

Module		**Contents**	**Hours**	**COs**
I		**Web programming fundamentals**	8	CO1
	1.1	Working of web browser, HTTP protocol, HTTPS, DNS, TLS, XML introduction, Json introduction, DOM, URL, URI, REST API. **Self-learning Topics:** Web development workflow, Web security.		
II		**JavaScript**	10	CO2
	2.1	Introduction to JavaScript: JavaScript language constructs, Objects in JavaScript- Built in, Browser objects and DOM objects, event handling, form validation and cookies. Introduction to ES5,ES6, Difference between ES5 and ES6. Variables, Condition, Loops, Functions, Events, Arrow functions, Setting CSS Styles using JavaScript, DOM manipulation, Classes and Inheritance. Iterators and Generators, Promise, Client-server communication, Fetch. **Self-learning Topics:** Functional programming, Web assembly.		
III		**React Fundamentals**	10	CO3
	3.1	Installation, Installing libraries, Folder and file structure, Components, Component lifecycle, State and Props, React Router and Single page applications, UI design, Forms, Events, Animations, Best practices.		

		Self-learning Topics: Error handling, Navigation using link and Navlink components.		
IV		**Node.js**	6	CO6
	4.1	Environment setup, First app, Asynchronous programming, Callback concept, Event loops, REPL, Event emitter, Networking module, Buffers, Streams, File system, Web module. **Self-learning Topics**: RBAC, Security practices.		
V		**Express**		
	5.1	Introduction, Express router, REST API, Generator, Authentication, sessions, Integrating with React. **Self-learning Topics:** Template engines, Form validation and error handling.	6	CO4
VI		**Advance React**		
	6.1	Functional components- Refs, Use effects, Hooks, Flow architecture, Model-View Controller framework, Flux, Bundling the application. Web pack. **Self-learning Topics:** Internationalization, Type-script with React.	5	CO5
		Total	45	

Exp. No.	List of Experiments	COs
1.	HTML: Elements, Attributes, Head, Body, Hyperlink, Formatting, Images, Tables, List, Frames, Forms, Multimedia	CO1
2.	CSS3.Syntax, Inclusion, Color, Background, Fonts, Tables, lists,CSS3 selectors, Pseudo classes, Pseudo elements	CO1
3.	Bootstrap: BootstrapGrid system, Forms, Button, Navbar, Breadcrumb, Jumbotron	CO2
4.	JavaScript: Variables, Operators, Conditions, Loops, Functions, Events, Classes and Objects, Error handling, Validations, Arrays, String, Date	CO3
5.	React: Installation and Configuration. JSX, Components, Props, State, Forms, Events, Routers, Refs, Keys.	CO5
6.	Node.js: Installation and Configuration, Callbacks, Event loops, Creating express app	CO4, 6
7.	To design and simulate the environment for Dynamic routing using Cisco packet tracer/ GNS3	CO1, 3
8.	To design and Simulate VLANs on the switch/router using Cisco packet tracer/ GNS3	CO1, 3
9.	To design and Simulate NAT on the router using Cisco packet tracer/ GNS3	CO1, 6
10.	Simulation of Software Defined Network using Mininet	CO5

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:

Web Development with Node and Express, Ethan Brown, O'Reilly

HTML5 Cookbook, By Christopher Schmitt, Kyle Simpson, O'Reilly Media

Core Python Applications Programming by Wesley J Chun Third edition Pearson Publication

Text Books:

Rediscovering JavaScript, Master ES6, ES7, and ES8, By Venkat Subramaniam · 2018

Learning React Functional Web Development with React and Redux, Alex Banks and Eve Porcello, O'Reilly

Learning Redux, Daniel Bugl, Packt Publication

Learning Node.js Development, Andrew Mead, Packt Publishing

RESTful Web API Design with Node.js 10, Valentin Bojinov, Packt Publication

Useful Links:

1. https://www.coursera.org/learn/tcpip?action=enroll
2. https://www.coursera.org/learn/tcpip?action=enrollhttps://react-redux.js.org/introduction/quick-start
3. https://www.coursera.org/learn/tcpip?action=enrollhttps://www.coursera.org/learn/tcpip?action=enroll

Course Title: Artificial Intelligence												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCC502B					
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:

1. To gain perspective of AI and its foundations.
2. To study different agent architectures and properties of the environment
3. To understand the basic principles of AI towards problem solving, inference, perception, knowledge representation, and learning
4. To investigate probabilistic reasoning under uncertain and incomplete information
5. To explore the current scope, potential, limitations, and implications of intelligent systems.

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

1. Identify the characteristics of the environment and differentiate between various agent architectures.
2. Apply the most suitable search strategy to design problem solving agents
3. Represent a natural language description of statements in logic and apply the inference rules to design Knowledge Based agents
4. Apply a probabilistic model for reasoning under uncertainty.
5. Comprehend various learning techniques
6. Describe the various building blocks of an expert system for a given real word problem.

Module		**Contents**	**Hours**	**COs**
I		**Introduction to Artificial Intelligence**	5	CO1
	1.1	Artificial Intelligence (AI), AI Perspectives: Acting and Thinking humanly, Acting and Thinking rationally		
	1.2	History of AI, Applications of AI, The present state of AI, Ethics in AI **Self-learning Topics:** Ethical Frameworks, Continuous Learning Human-in-the-Loop Approaches		
II		**Intelligent Agents**	5	CO2
	2.1	Introduction of agents, Structure of Intelligent Agent, Characteristics of Intelligent Agents		
	2.2	Types of Agents: Simple Reflex, Model Based, Goal Based, Utility Based Agent		
	2.3	Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent **Self-learning Topics:** Genetic Representation of Agents, Fitness Evaluation, Environmental Interaction, Adaptive Learning and Improvement		
III		**Solving Problems by Searching**		

	3.1	Definition, State space representation, Problem as a state space search, Problem formulation, Well-defined problems	12	CO3
	3.2	Solving Problems by Searching, Performance evaluation of search strategies, Time Complexity, Space Complexity, Completeness, Optimality		
	3.3	Uninformed Search: Depth First Search, Breadth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bidirectional Search		
	3.4	Informed Search: Heuristic Function, Admissible Heuristic, Informed Search Technique, Greedy Best First Search, A* Search, Local Search: Hill Climbing Search, Simulated Annealing Search, Optimization: Genetic Algorithm		
	3.5	Game Playing, Adversarial Search Techniques, Mini-max Search, Alpha-Beta Pruning **Self-learning Topics:** Metaheuristic Algorithms for Problem Solving in AI Key components of this topic may include: Algorithm Overview ,Problem Representation ,Search Space Exploration, Adaptation and Evolution		
IV		**Knowledge and Reasoning**		
	4.1	Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems.	10	C04
	4.2	Propositional Logic (PL): Syntax, Semantics, Formal logic-connectives, truth tables, tautology, validity, well-formed-formula, Introduction to logic programming (PROLOG).		
	4.3	Predicate Logic: FOPL, Syntax, Semantics, Quantification, Inference rules in FOPL		
	4.4	Forward Chaining, Backward Chaining and Resolution in FOPL **Self-learning Topics:** Advanced Syntax and Semantics, real time examples of FOPL, PL		
V		**Reasoning Under Uncertainty**		
	5.1	Handling Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Inference using Full Joint Distribution	8	C05
	5.2	Bayes' Rule and its use, Bayesian Belief Networks, Reasoning in Belief Networks **Self-learning Topics:** Advanced Bayesian Inference, Bayesian Optimization ,Causal Inference with Bayesian Networks		
VI		**Planning and Learning**		
	6.1	The planning problem, Partial order planning, total order planning.		
	6.2	Learning in AI, Learning Agent, Concepts of Supervised, Unsupervised, Semi Supervised Learning, Reinforcement Learning, Ensemble Learning.	8	C06
	6.3	Expert Systems, Components of Expert System: Knowledge base, Inference engine, user interface, working memory, Development of Expert Systems. **Self-learning Topics:** Deep Learning, Generative Adversarial Networks (GANs),Transfer Learning, Rule-Based Systems, Knowledge Engineering, Development Tools for Expert Systems		

		Total	45	

Exp. No.	List of Experiments	COs
1.	Provide the PEAS description and TASK Environment for a given AI problem	CO1
2.	Identify suitable Agent Architecture for the problem	CO1
3.	Write simple programs using PROLOG as an AI programming Language	CO5
4.	Implement any one of the Uninformed search techniques	CO3
5.	Implement any one of the Informed search techniques E.g. A-Star algorithm for 8 puzzle problem	CO1, 3
6.	Implement adversarial search using min-max algorithm.	CO3
7.	Implement any one of the Local Search techniques. E.g. Hill Climbing, Simulated Annealing, Genetic algorithm	CO3
8.	Prove the goal sentence from the following set of statements in FOPL by applying forward, backward and resolution inference algorithms	CO4
9.	Create a Bayesian Network for the given Problem Statement and draw inferences from it. (You can use any Belief and Decision Networks Tool for modeling Bayesian Networks)	CO5
10.	Implement a Planning Agent	CO2
11.	Design a prototype of an expert system	CO6
12.	Case study of any existing successful AI system	CO1

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
6. 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:

https://onlinecourses.nptel.ac.in/noc22_cs56/preview

https://nptel.ac.in/courses/106105077

http://www.classcentral.com/course/independent-elements-of-ai-12469

Course Title: Agile and Project Management												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCC5011B					
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 the principles and practices of traditional and Agile project management.
2. To apply knowledge of project planning, execution, monitoring, and closure.
3. To demonstrate proficiency in Agile frameworks like Scrum, Kanban, and XP.
4. To use tools and techniques for risk, scope, cost, time, and quality management.
5. To develop skills to work in and manage Agile teams effectively.
6. To analyse and select appropriate project methodologies for different project scenarios.

Course Outcomes:

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

1. CO1: Explain the concepts and importance of project management and Agile practices.
2. CO2: Demonstrate competency in Agile methodologies and iterative development.
3. CO3: Apply project planning and estimation techniques using real-life scenarios.
4. CO4: Utilize tools for task tracking, scheduling, and collaboration in Agile projects.
5. CO5: Analyse project risks and apply mitigation strategies effectively.
6. CO6: Create and manage Agile documentation including user stories, product backlogs, and sprint planning.

Module		Contents	Hours	COs
I		**Introduction to Project Management**		
	1.1	Introduction to Project Management Introduction: Definition & Characteristics of a Project, Project vs Operations Project Life Cycle: Phases: Initiation, Planning, Execution, Monitoring & amp; Controlling, Closure. Traditional Project Management Methodologies: Waterfall, V-Model: use cases and limitations. Waterfall vs Agile **Self Learning Topics**: Project Success Factors, Iron Triangle (Scope, Time, Cost), quality, stakeholder satisfaction.	7	CO1
II		**Agile Overview and Principles**		
	2.1	Agile Introduction: History of Agile, Agile Manifesto, 12 Agile principles, Agile vs Traditional Approaches, Iterative vs Incremental Agile Mindset: Value delivery, cross-functional teams, continuous Improvement. Agile Project Lifecycle: Concept, Inception, Iteration, Release, Maintenance. Self-Learning Topics: Case Studies on Product Lifecycle implementing Agile Methodologies	8	CO2
III		**Scrum Framework and Agile Roles**		
	3.1	Scrum Overview: Empirical process control, transparency, inspection, Adaptation. Scrum Roles & amp; Events: Product Owner (PO): Vision, backlog Prioritization. Scrum Master (SM): Facilitation, removing impediments. **Self-Learning Topics:** Definition of Done (DoD) and Acceptance Criteria	8	CO3
IV		**Project Planning and Estimation**		
	4.1	**Work Breakdown Structure (WBS),** Estimation techniques (Planning Poker, T-shirt sizing): Story Points, T-shirt sizing, ideal hours. Consensus-based estimation Using Fibonacci scale. **Self-Learning Topics:** Backlog Grooming and Refinement	7	CO4
V		**Risk, Quality, and Communication Management**		
	5.1	Introduction: Understanding of Risk, Risk Identification (RAID Log), qualitative & quantitative analysis, response planning. Risk Mitigation in Agile: Frequent delivery, buffer tasks, retrospectives, Quality standards: Quality assurance vs control, **Self-Learning Tools:** Visual tools in Agile i.e. Task boards, burn down Charts, dashboards.	8	CO5

VI		**Agile Tools and Real-world Applications**	7	CO6
	6.1	Agile Project Management Tools: JIRA, Trello. Version Control and Collaboration : GitHub Projects, Agile metrics Agile Transformation Challenges: Resistance to change, scaling issues, Distributed teams. **Self-learning Topics:** Case studies on Agile project success, Real-life Agile implementations from companies like Spotify, Google, Infosys.		
		Total	45	

Exp. No.	List of Experiments	COs
1.	Create a project charter and stakeholder register	CO1,CO3
2.	Design a Product Backlog and prioritize using MoSCoW technique	CO2,CO6
3.	Create Sprint Backlog and define tasks with acceptance criteria	CO4,CO6
4.	Simulate a Scrum Ceremony (Daily Stand-up, Planning, Review)	CO2,CO4
5.	Perform estimation using Planning Poker and Fibonacci series	CO3,CO6
6.	Implement a project board using JIRA or Trello	CO4,CO6
7.	Monitor project progress using Burndown Chart and Velocity Chart	CO4,CO5
8.	Conduct a risk analysis and develop mitigation plans	CO5
9.	Develop a communication plan and stakeholder matrix	CO5,CO6
10.	Prepare project closure report with lessons learned and retrospectives	CO1,CO5,CO6

Assessment:

Evaluation Scheme and Assessment:

Internal Assessment Examination:

Assessment consists of two class tests of 20 marks each. The 1 st class test is to be conducted when approx. 40% syllabus is completed and 2 nd class test when additional 40-60 % syllabus is completed. Duration of each test shall be one hour.

End Semester Theory Examination:

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

Continuous Assessment(CA)/Term Work(TW):

1. Term work should consist of 10 experiments.
2. Journal must include at least 2 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance Of laboratory work and minimum passing marks in term work.
4. Total 25 Marks: (Minimum passing marks is 40%)

Experiments: 15 marks

Attendance (Theory & Practical): 05 marks

Assignments: 05 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

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

Oral & amp; Practical Exam

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

Text Books:

1. Project Management Institute (PMI), A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Edition, PMI Publications, 2021
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, 1 st edition, Addison-Wesley, 2012
3. Mike Cohn, Agile Estimating and Planning, 1 st Edition, Prentice hall, 2005

Reference Books:

1. Jeff Patton,"User Story Mapping: Discover the Whole Story, Build the Right Product", 1stEdition, O'Reilly Media, 2014
2. Scott Berkun, "The Art of Project Management", 1st Edition, O'Reilly Media, 2005

Useful Links

1. https://onlinecourses.nptel.ac.in/noc25_mg71/preview
2. https://swayam.gov.in/nd2_cec20_cs07/preview
3. https://elearn.nptel.ac.in/shop/nptel/ignite-your-agile-journey-unveiling-core-values-principles

Course Title: Information of Network Security												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCE5012B					
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:

CO1: To introduce fundamental concepts of information security, cryptography, and network threats.
CO2: To explore modern cryptographic techniques and their applications in securing data and Communications.
CO3: To understand authentication mechanisms, firewalls, intrusion detection, and secure protocols.
CO4: To develop awareness of real-world security vulnerabilities and their mitigation strategies.
CO5: To prepare students to design secure systems and understand ethical/legal considerations in Cybersecurity.
CO6: To prepare students to design secure systems and understand ethical/legal considerations in Cybersecurity.

Course Outcomes:

CO1: Explain the principles of information and network security and common attack vectors.
CO2: Apply classical and modern cryptographic algorithms for secure communication.
CO3: Implement authentication mechanisms and digital signatures in secure systems.
CO4: Analyze network security threats, intrusion detection systems, and firewall architectures.
CO5: Evaluate and recommend security solutions for real-world case studies involving AI/ML Systems.
CO6: Demonstrate awareness of legal frameworks and ethical practices in cybersecurity and AI Systems.

Module		**Contents**	**Hours**	**COs**
I		**Introduction to Information Security**	8	CO1
	1.1	CIA triad, vulnerabilities, threats, attacks, security models, ISO 27001, risk assessment, AI security introduction. **Self-study:** - Study a real-life security breach in India (e.g. Aadhaar data leak)		
II		**Cryptography Basics**	12	CO2
	2.1	Classical ciphers, DES, AES, RSA, Diffie-Hellman, Key exchange, Cryptanalysis. **Self-Study:-** Explore Elliptic Curve Cryptography (ECC) and its advantages.		
III		**Authentication and Integrity**		

	3.1	Authentication protocols, password security, hash functions (MD5, SHA-256), digital signatures, PKI **Self-Study:-**Research certificate authority compromise (e.g., DigiNotar)	8	CO3
IV		**Network Security Essentials**	6	CO4
	4.1	Firewalls, IDS/IPS, SSL/TLS, HTTPS, IPsec, VPNs, proxies, DNS security **Self-Study: -** Analyze packet capture using Wireshark (SSL Handshake)		
V		**Security in AI/Cloud Environments**	6	CO5
	5.1	AI pipeline threats, adversarial attacks, data poisoning, federated learning, IAM, cloud misconfigurations. **Self-Study:** - Read OWASP AI Top 10 Vulnerabilities.		
VI		**Cyber Law, Ethics & Emerging Trends**	5	CO6
	6.1	IT Act, GDPR, DPDP Bill, ethical hacking, blockchain security, Zero Trust architecture. **Self- Study: -** Explore quantum cryptography and its implications.		
		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.

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.

Reference Books:

1) Bruce Schneier, Applied Cryptography: Protocols, Algorithms, and Source Code in C, Wiley

2) Matt Bishop, Computer Security: Art and Science, Addison-Wesley

Text Books:

1) William Stallings – Cryptography and Network Security, Pearson

2) Behrouz Forouzan – Cryptography and Network Security, McGraw-Hill

Course Title: Data Engineering for BI												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCE5021B					
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 introduce the fundamental concepts of data engineering and its role in Business Intelligence (BI).
2. To explain the processes of data collection, integration, cleaning, and transformation for BI Applications.
3. To familiarize students with data pipelines and workflow orchestration tools used in data Engineering.
4. To enable learners to design and implement data warehouses and understand dimensional Modeling.
5. To develop the ability to apply ETL (Extract, Transform, Load) techniques for preparing data for BI tools.
6. To enhance proficiency in using data engineering tools and techniques to support business

Course Outcomes: Learner will be able to

1. Describe the key concepts, architecture, and significance of data engineering in Business Intelligence systems.
2. Apply methods for data acquisition, cleaning, integration, and transformation to ensure data quality and readiness.
3. Design and implement scalable data pipelines using modern tools and technologies.
4. Develop and manage data warehouses using dimensional modeling techniques for BI reporting.
5. Execute ETL processes efficiently to prepare and load data into BI systems.
6. Use data engineering practices to support data-driven decision-making in a business context.

Module		**Contents**	**Hours**	**COs**
I		**Business intelligence**	5	CO1
II		**Mathematical models for decision making**	7	CO2
	2.1	Structure of mathematical models, Development of a model, Classes of models Data mining: Definition of data mining, Representation of input data, Data mining process, Analysis methodologies Data preparation: Data validation, Data transformation, Data reduction **Self-learning Topics**: Optimization software (e.g., LINGO, Gurobi, Solver in Excel),Decision trees and influence diagrams		
III		**Classification and Clustering**	8	CO3
	3.1	Classification: Classification problems, Evaluation of classification		

		models, Bayesian methods, Logistic regression, Neural networks, Support vector machines Clustering: Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models. **Self-learning Topics:** Confusion matrix, precision, recall, F1 score, ROC curves, Ensemble learning methods (Random Forests, Boosting)		
IV		**Business intelligence applications**	10	CO4
	4.1	Marketing models: Relational marketing, Sales force management, Logistic and production models: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. Data envelopment analysis: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices **Self-learning Topics:** Linear and non-linear optimization in logistics,DEA software tools (e.g., DEA-Solver, MaxDEA)		
V		**Knowledge Management**	10	CO5
	5.1	Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management. **Self-learning Topics:** Communities of practice (CoPs),Case studies: KM in Toyota, IBM, NASA.		
VI		**Artificial Intelligence and Expert Systems**	5	CO6
	6.1	Artificial Intelligence and Expert Systems: Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems **Self-learning Topics:** Use of PROLOG or CLIPS in building expert systems Applications in medical diagnosis and customer service.		
		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.

C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All C

Os / 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 Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis Wiley, First 2009

2 Decision support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, Dursun Delen Pearson Ninth 2011

3 Fundamental of Business Intelligence Grossmann W, Rinderle-Ma Springer First 2015

Text Books:

1. Business Intelligence: A Managerial Perspective on Analytics by Ramesh Sharda, Dursun Delen, Efraim Turban, Pearson, 10th Edition, 2020.
2. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, 3rd Edition, 2011.
3. Business Analytics: Data Analysis & Decision Making by S. Christian Albright, Wayne L. Winston, Cengage Learning, 6th Edition, 2016.

Useful Links:

1 https://learn.microsoft.com/en-us/training/powerbi/
2 https://rapidminer.com/
3 https://www.kdnuggets.com/

Course Title : AI & ML for Health and Social Care												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLPCE5022B					
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	25	150

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

Course Objectives:

1. To understand the need and significance of AI and ML for Healthcare.
2. To study advanced AI algorithms for Healthcare.
3. To learn Computational Intelligence techniques .
4. To understand evaluation metrics and ethics in intelligence for Healthcare systems,
5. To learn various NLP algorithms and their application in Healthcare,
6. To investigate the current scope, implications of AI and ML for developing futuristic Healthcare Applications.

Course Outcomes:

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

1. Understand the role of AI and ML for handling Healthcare data.
2. Apply Advanced AI algorithms for Healthcare Problems.
3. Learn and Apply various Computational Intelligence techniques for Healthcare Application.
4. Use evaluation metrics for evaluating healthcare systems.
5. Develop NLP applications for healthcare using various NLP Techniques.
6. Apply AI and ML algorithms for building Healthcare Applications

Module		Contents	Hours	COs
I		**Introduction**	6	CO1
1.1	1.1	Overview of AI , ML and DL ,A Multifaceted Discipline, Applications of AI in Healthcare - Prediction, Diagnosis, personalized treatment and behaviour modification, drug discovery, follow-up care etc.		
	1.2	**Self-learning Topics:** Medical Imaging Analysis, Natural Language Processing (NLP) in Healthcare		
II		**AI, ML, Deep Learning and Data Mining Methods for Healthcare**	10	CO2
	2.1	Knowledge discovery and Data Mining, ML, Multi classifier Decision Fusion, Ensemble Learning, Meta-Learning and other Abstract Methods.		
	2.2	Evolutionary Algorithms, Illustrative Medical Application- Multiagent Infectious Disease Propagation and Outbreak		

		Prediction, Automated Amblyopia Screening System etc.		
	2.3	Computational Intelligence Techniques, Deep Learning, Unsupervised learning, dimensionality reduction algorithms. **Self-learning Topics:** Predictive Analytics in Healthcare, Natural Language Processing (NLP) for Healthcare		
III		**Evaluating learning for Intelligence**	6	CO3
	3.1	Model development and workflow, evaluation metrics, Parameters and Hyperparameters, Hyperparameter tuning algorithms, multivariate testing, Ethics of Intelligence. **Self-learning Topics:** Cognitive Psychology, Creative Thinking		
IV		**Natural Language Processing in Healthcare**	8	CO4
	4.1	NLP tasks in Medicine, Low-level NLP components, High level NLP components, NLP Methods.		
	4.2	Clinical NLP resources and Tools, NLP Applications in Healthcare. Model Interpretability using Explainable AI for NLP applications. **Self-learning Topics:** Medical Coding Automation, Patient Question Answering Systems		
V		**Intelligent personal Health Record**	5	CO5
	5.1	Introduction, Guided Search for Disease Information, Recommending SCA's. Recommending HHP's , Continuous User Monitoring. **Self-learning Topics:** Technology Infrastructure, Data Security and Privacy		
VI		**Future of Healthcare using AI**	10	CO6
	6.1	Evidence based medicine, Personalized Medicine, Connected Medicine, Digital Health and Therapeutics, Conversational AI, Virtual and Augmented Reality, Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals, Case Studies on use of AI and ML for Disease Risk Diagnosis from patient data, Augmented reality applications for Junior doctors.		
	6.2	Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals, Case Studies on use of AI and ML for Disease Risk Diagnosis from patient data, Augmented reality applications for Junior doctors. **Self-learning Topics:** Clinical Decision Support Systems (CDSS), Medical Imaging and Diagnostics		
		Total	45	

Exp. No.	List of Experiments	COs
1	Collect, Clean, Integrate and Transform Healthcare Data based on specific disease.	CO1
2	Perform Exploratory data analysis of Healthcare Data.	CO1
3	AI for medical diagnosis based on MRI/X-ray data.	CO1,2
4	AI for medical prognosis .	CO1,2
5	Natural language Entity Extraction from medical reports.	CO3
6	Predict disease risk from Patient data.	CO4
7	Medical Reviews Analysis from social media data.	CO5
8	Explainable AI in healthcare for model interpretation.	CO6
9	Mini Project-Design and implement innovative web/mobile based AI application using Healthcare Data. (this needs to be implemented in group of 3-4 students)	CO5
10	Documentation and Presentation of Mini Project.	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. Erik R. Ranschaert Sergey Morozov Paul R. Algra, "Artificial Intelligence in medical Imaging- Opportunities, Applications and Risks", Springer
2. Sergio Consoli Diego Reforgiato Recupero Milan Petković,"Data Science for Healthcare- Methodologies and Applications", Springer
3. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, Gia Nhu Nguyen, "Emerging technologies for health and medicine", Wiley.
4. Ton J. Cleophas Aeilko H. Zwinderman, "Machine Learning in Medicine- Complete Overview", Springer

Text Books:

1. Arjun Panesar, "Machine Learning and AI for Healthcare", A Press.
2. Arvin Agah, "Medical applications of Artificial Systems ", CRC Press

Useful Links

1. https://www.coursera.org/learn/introduction-tensorflow?specialization=tensorflow-in-practice
2. https://www.coursera.org/learn/convolutional-neural-networks-tensorflow? specialization=tensorflo w- in-practice
3. https://datarade.ai/data-categories/electronic-health-record-ehr-data
4. https://www.cms.gov/Medicare/E-Health/EHealthRecords
5. https://www.coursera.org/learn/tensorflow-sequences-time-series-and-prediction? specialization=te nsorflow-in-practice

Course Title: Design Thinking

Semester: V			Term: ODD				Course Code: 24OE5011B					
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, TW: Term Work

Course Objectives:

1. To introduce a learner to the principles of Design Thinking
2. To familiarize a learner with the process (stages) of Design Thinking
3. To expose a learner to various case studies of Design Thinking

Course Outcomes:

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

1. To compare traditional approach to problem solving with the Design Thinking approach and discuss the principles along with the process of Design Thinking
2. To define a user persona using Empathy Mapping
3. To frame a problem statement using various Design Thinking tools
4. To select best idea among the ideas generated through various Design Thinking tools
5. To create prototypes using engineering principles
6. To test the prototypes and gather feedback for refining the prototype

Module	Contents	Hours	Cos
I	**Introduction to Design Thinking**	6	CO1
	Definition, comparison of traditional approach with Design Thinking, process (stages) of Design Thinking, case studies		
II	**Creating User Persona**	8	CO2
	Interview technique, user observation technique, creation of empathy map		
III	**Defining problem statement**	8	CO3
	Cause and effect, mind mapping and journey maps technique		
IV	**Ideation**	8	CO4
	Brain storming, Bench marking and prioritizing technique		
V	**Prototype generation**	8	CO5
	Rules of prototype generation, Low and high-fidelity prototypes, Prototyping techniques - Paper, Digital and 3D prototyping		
VI	**Testing the prototype**	7	CO6

	Evaluation techniques: Interviews, User observation, Wireframing, A/B Testing		
	Total	**45**	

Sr. No.	Suggested Activities List	COs
1.	Conducting user interviews and observations for a specific product or system to identify user pain points. Prepare an empathy map.	CO1
2.	Developing detailed user personas based on their empathy research.	CO2
3.	Synthesizing the findings from user research to define a clear problem statement in engineering terms.	CO3
4.	Performing a brainstorming session within the group using mind mapping techniques to generate creative solutions to the defined problem.	CO4
5.	Creating a prototype for selected idea using engineering principles. Prototype could be a physical model, electronic circuits, web or mobile app or a combination of these.	CO5
6.	Testing the prototype with the users and gathering feedback to created refined prototype.	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.

Reference Books:

1. Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, Idris Mootee, Wiley, 2013
2. Change by Design, Tim Brown, Harper Business, 2009

Text Books:

1. Design Thinking: Methodology Book, Emrah Yayichi, 2016
2. Handbook of Design Thinking: Christian Mueller-Roterberg, 2018

Useful Links:

1. Empathy map
   https://www.nngroup.com/articles/empathy-mapping/
2. Prototyping
   https://staragile.com/blog/prototype-in-design-thinking
3. Design Thinking case studies
   https://voltagecontrol.com/blog/8-great-design-thinking-examples/
   https://dyworks.in/design-thinking-case-studies/

Course Title: Research Methodology

Semester: V			Term: ODD				Course Code: 24OE5012B					
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. Understand the fundamental concepts of research including constructs, hypotheses, propositions,
2. Differentiate among various types of research and apply appropriate research.
3. Design effective
4. Apply the stages of the scientific research process from problem identification to report writing.
5. Formulate a relevant and feasible research problem considering key practical factors such as data availability and interpretation.
6. Evaluate research outcomes critically, test validity, and address ethical issues while presenting actionable recommendations.

Course Outcomes:

1. Understand fundamental research concepts such as constructs, hypotheses, postulates.
2. Identify and differentiate various types of research (e.g., basic, applied, analytical, empirical)
3. Develop an appropriate research and sample design, identifying stages and techniques, and recognize potential sampling errors.
4. Apply the scientific research process, from selecting a research problem to preparing the final report, including data collection, analysis, and hypothesis testing
5. Formulate a relevant and feasible research problem
6. Evaluate research outcomes by testing validity, addressing ethical issues, and proposing practical recommendations based on findings

Module	Contents (All Modules are hands on only)	Hours	COs
I	**Module 1: Introduction and Basic Research Concepts** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences, Objectives of Research, Issues and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	10	1
II	**Module 2: Types of Research** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	8	2
III	**Module 3: Research Design and Sample Design** Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	8	3
IV	**Module 4: Research Methodology** Meaning of Research Methodology ,Stages in Scientific Research Process: Identification and Selection of Research Problem, Formulation of Research Problem, Review of Literature, Formulation of Hypothesis, Formulation of research Design, Sample Design , Data Collection, Data= Analysis, Hypothesis testing and Interpretation of Data, Preparation of Research Report	6	4
V	**Module 5: Formulating Research Problem** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	8	5
VI	**Module 6: Outcome of Research** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	5	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.

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. **Uma Sekaran & Roger Bougie**
   Title: *Research Methods for Business: A Skill Building Approach*
   Publisher: Wiley
2. **Donald R. Cooper & Pamela S. Schindler**
   Title: *Business Research Methods*
   Publisher: McGraw Hill
3. **Zikmund, Babin, Carr & Griffin**
   Title: *Business Research Methods*
   Publisher: Cengage Learning

Text Books:

1. **C.R. Kothari & Gaurav Garg**
   Title: *Research Methodology: Methods and Techniques*
   Publisher: New Age International Publishers
2. **Ranjit Kumar**
   Title: *Research Methodology: A Step-by-Step Guide for Beginners*
   Publisher: SAGE Publications

Course Title: Basics of Marketing Management												
Semester: V			Term: ODD			Course Code: 24OE5014B						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IA E 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 basic concepts and functions of marketing.
2. To help students understand consumer behavior and market segmentation.
3. To familiarize students with product, pricing, promotion, and distribution strategies.
4. To provide an understanding of modern marketing trends including digital and green marketing.
5. To enable engineering students to apply marketing principles in technology-driven environments.

Course Outcomes:

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

1. Define key marketing terms and explain the role of marketing in organizations...
2. Analyze consumer behavior and segment markets effectively
3. Apply the marketing mix (4Ps) in real-world scenarios.
4. Evaluate marketing strategies using SWOT and competitor analysis.
5. Identify and explain emerging marketing practices such as digital, green, and social marketing.
6. Integrate basic marketing knowledge into engineering projects and innovations.

Module	Contents	Hours	COs
I	**Introduction to Marketing**	**06**	CO1
	Definition, nature, scope, and importance of marketing Core marketing concepts: Needs, Wants, Demand, Value, Exchange Evolution of marketing: Production to Relationship orientation Role of marketing in business and society **Self-learning Topic:** Case Study Analysis – How Apple Uses Marketing to Create Customer Value		
II	**Understanding the Market and Consumer Behavior**	08	CO2

	Marketing environment: Micro and Macro Buyer decision process – stages and influencing factors Market segmentation: Bases and strategies Targeting and Positioning (STP) **Self-learning Topic:** Consumer Behavior Models (e.g., AIDA, Maslow's Hierarchy) and Their Real-World Applications		
III	**Marketing Mix - Product and Price**	08	CO3
	Product: Levels, types, lifecycle, new product development Branding, Packaging, and Labeling Pricing: Objectives, strategies, and methods Factors affecting pricing decisions **Self-learning Topic:** Skimming vs. Penetration Pricing – Strategies Used by Tech Startups		
IV	**Marketing Mix - Place and Promotion**	08	**CO3**
	Distribution channels: Types and functions Retailing, Wholesaling, and Logistics Promotion mix: Advertising, Sales Promotion, Public Relations, Direct Marketing, Personal Selling Integrated Marketing Communication (IMC) **Self-learning Topic:** Role of Influencer Marketing in Brand Promotion		
V	**Strategic Marketing and Modern Trends**	**08**	**CO4, CO5**
	SWOT analysis and marketing planning BCG Matrix, Ansoff Matrix Digital Marketing: SEO, SEM, Social Media Marketing, Email Marketing E-commerce and m-commerce strategies **Self-learning Topic:** Google Ads vs. Social Media Ads – ROI Comparison and Strategy Design		
VI	**Social Responsibility and Applications of Marketing**	07	**CO5, CO6**
	Green marketing and sustainability Ethical issues in marketing Rural marketing in India Applying marketing principles to engineering innovations/		

	startups **Self-learning Topic:** Marketing Strategies for Rural India – Case of Patanjali or Amul		
	Total	**45**	

Suggested Activities and Mini Project:

- Case study analysis on marketing strategies of tech companies
- Group presentation on digital marketing tools
- Survey-based project on consumer behavior for a product
- Role-play for product launching and branding
- Design a basic marketing plan for an engineering project/startup

Evaluation and Assessment Scheme:

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.

Reference Books:

1. S.A. Sherlekar, Marketing Management, Himalaya Publishing.
2. Grewal & Levy, Marketing, McGraw-Hill Education.
3. Tracy L. Tuten, Principles of Marketing for a Digital Age, SAGE Publications.

Text Books:

1. Philip Kotler, Marketing Management, Pearson Education.
2. Ramaswamy & Namakumari, Marketing Management: Global Perspective Indian Context, Macmillan..

Course Title: Corporate Communication & Employability Skills - I (CCES - I)												
Semester: V			Term: ODD			Course Code: 24AIMLEEP501B						
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

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

Course Objectives:

1. To understand and apply LSRW skills in academic, professional and social situations.
2. To apply grammar and vocabulary correctly in oral and written communication situations.
3. To equip students with the techniques of inter-personal skills and employability skills for their personal and organizational development.

Course Outcomes:

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

1. Demonstrate effective inter-personal skills, such as active listening, empathy, and conflict resolution, to build and maintain positive relationships.
2. Use punctuation, syntax, and other language conventions correctly to produce polished and professional documents.
   Develop employability skills, including teamwork, leadership, problem-solving, and adaptability, to thrive in the workplace..

Module	Contents	Hours	COs
I	**Developing Speaking & Presentation Skills** 1) Formal & Informal: Situational Dialogues 2) Elements of Speaking Skills: Vocabulary, Grammar, Pronunciation, Fluency, Tone 3) Types of Speech: Welcome Speech, Introductory Speech, Impromptu, Public Speech, Farewell Speech, Vote of Thanks, Eulogy & Condolence Speech. Tips for enhancing speeches. **Self-learning Topics: Develop cultural awareness and sensitivity when speaking to diverse audiences. Understand how cultural differences may influence communication styles, norms, and expectations.**	**06**	CO1

II	**Verbal Aptitude on Grammar & Vocabulary** Grammar 1) Parts of Speech 2) Modal Auxiliaries- Primary & Secondary 3) Articles: Definite & Indefinite, Exceptions of using articles 4) Uses of Tenses: Present & Past Tense Vocabulary 1) Synonyms, Antonyms, Prefixes, Suffixes 2) Homophones, Homonyms, Acronyms **Self-learning Topics:** Practice reading passages of varying complexity and genres, and develop strategies for understanding main ideas, identifying supporting details, and making inferences.	02	CO2
III	**Writing Skills** **1)** Email Writing: Etiquette, Netiquette, Do's & Don'ts **2)** Writing Notice, Agenda & Minutes of a Meeting **3)** Introduction to Proposal Writing, Parts of a Proposal, Types of Proposal: Research, Business **4)** Writing Article Review **Self-learning Topics:** Learn how to adapt your writing for different platforms and mediums, such as print publications, websites, social media, or multimedia presentations.	03	CO2
IV	**Interpersonal Skills** 1) Presentation Skills: Power Point, Demo Presentation 2) Managerial Skills: Time Management, Goal Setting, Decision Making, Conflict Resolution, Team Building, Leadership, Emotional Intelligence, Critical Thinking, Assertiveness, Negotiation **Self-learning Topics:** Develop adaptability and flexibility to navigate different social situations and interact effectively with a wide range of personalities. Learn how to adjust your communication style, behaviour, and approach to suit the preferences and needs of others	04	CO3
V	**Employability Skills** 1) SWOT Analysis: Personal & Organizational 2) Verbal Aptitude Test 3) Group Discussion Skills: Types of GD, Do's and Don'ts, Tips for cracking a GD 4) Resume Writing 5) Interview Techniques **Self-learning Topics:** Develop adaptability and flexibility to navigate different social situations and interact effectively with a wide range of personalities.	04	CO3

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.

Tut No.	List of Tutorials	Hr.	CO
	Listening Skills		
1	1. IELTS Listening	**1**	**1**
	Speaking Skills		
2	1.Speech: Welcome/Farewell/Vote of Thanks	**1**	**1**
3	2.Technical Poster Presentation	**1**	**1**
4	3.Book Review	**1**	**1**

5	4.Newspaper Article Presentation	**1**	**2**
6	5.Group Discussion (2 rounds)	**2**	**3**
7	6.Mock Interview (HR Round)	**1**	**3**
8	7. Mock Interview (HR + Technical 2Hours)	**2**	**3**
Reading Skills			
9	1.Newspaper Article	**1**	**1**
Writing Skills			
10	1.Email Writing	**1**	**2**
11	2.Writing & Presenting Article Review	**1**	**2**
12	3. Notice, Agenda & Minutes	**1**	**2**

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. Locker O Kitty & Kaczmarek Kyo Stephen, Business Communication Building Critical Skills, McGraw Hill Education Private Limited, 2007
8. Chaturvedi P D & Chaturvedi Mukesh, Business Communication Concepts, Cases and Applications, Pearson Education, 2008

Text Books:

1. Luthans Fred, Organizational Behavior An Evidence-Based Approach, McGraw Hill Education Private Limited, 2013

Useful Links:

- https://youtu.be/-x125fNrFxM?si=StDEUJZSDbC2wVxc
- https://youtu.be/aD6sBAsYnYE?si=LNMXzC89QCvYa0mh
- https://youtu.be/aD6sBAsYnYE?si=Ixc9FOdV0WBzQTRg
- https://youtu.be/mQL3aZa21EY?si=4cqWLxgAnSv6hkFC
- https://youtu.be/V2azCSchs58?si=j3uzd-Wsl8DReuPW
- https://youtu.be/3w32jIsRlsw?si=v9t3VYNEv-bezxLG

Course Title: Employability Enhancement Program (Technical)												
Semester: V			**Term:** Odd				**Course Code:** 24AIMLEEP501B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**AE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	4	-	-	2	2	--	--	--	25	--	25

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

Course Title: Employability Enhancement Program – 5 (Advance Python Programming)												
Semester: V			**Term: ODD**				**Course Code: 24CSDSVSE501B**					
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**							
1	--	4	1	--	2	3	10	10	30	25	--	75

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

Course Objectives:

1. Understand advanced features and capabilities of the Python language.
2. Apply object-oriented programming concepts effectively in real-world scenarios.
3. Handle various data formats and perform file operations.
4. Automate tasks and scrape web data using Python libraries.
5. Use popular libraries for data analysis, visualization, and simple web development.
6. Write testable, deployable, and maintainable Python applications for production use.

Course Outcomes:

1. Develop Python applications using advanced features such as decorators, generators, and comprehensions.
2. Implement object-oriented designs and use class-related functionalities efficiently.
3. Perform data processing and manage structured file formats using Python.
4. Create automation scripts and perform data extraction from the web.
5. Build mini data science and web apps using Python frameworks and libraries.
6. Apply best practices in testing, packaging, and code versioning for professional software development.

Module	Contents	Hours	COs
I	**Module 1: Advanced Python Concepts** Basic Python brush-up, Iterators and Generators Decorators and Context Managers Lambda, Map, Filter, Reduce Comprehensions (List, Dict, Set) Exception Handling Best Practices **Self-learning Topics : Logic building using python**	10	1
II	**Module 2: Object-Oriented Python** Advanced OOPs: Inheritance, Polymorphism, Abstraction, Encapsulation Magic (Dunder) MethodsClass and Static Methods Abstract Classes and Interfaces using abc Property Decorators **Self-learning Topics : Python real world scenario implementation using OOPs.**	10	2
III	**Module 3: File Handling and Working with Data** Working with different file formats (JSON, CSV, XML) Reading and Writing Binary Files File Compression using zipfile, tarfile Logging module Serialization using pickle, shelve **Self-learning Topics : Data logging in file**	12	3
IV	**Module 4: Python for Automation and Web Scraping** Automating tasks using os, shutil, subprocess Sending emails, reading PDFs/Excel Web scraping using requests, BeautifulSoup, Selenium Cron Jobs or Task Scheduler Integration **Self-learning Topics : Web scrapping using python**	08	4
V	**Module 5: Working with Libraries and Frameworks** NumPy and Pandas: Data manipulation Matplotlib and Seaborn: Data visualization SQLite and SQLAlchemy (ORM) Introduction to Flask (Basics of Web Development) **Self-learning Topics : Web development using flask**	10	5
VI	**Module 6: Testing, Packaging, and Deployment** Unit Testing with unittest and pytest Code linting: pylint, flake8 Packaging with setuptools Version Control with Git & GitHub Virtual Environments and Dependency Management **Self-learning Topics : Unit testing on web application**	10	6
	Total	**45**	

Evaluation and Assessment Scheme:

Sr. No.	List of Experiments	CO
1	Implement a generator for prime number series.	1
2	Create a class with multiple inheritance and demonstrate method overriding.	2
3	Develop a custom context manager for file operations.	1
4	Read and process data from a CSV file using Pandas.	3
5	Create a decorator that logs function execution time.	1
6	Automate folder backup using shutil and os.	4
7	Build a simple web scraper to fetch job listings from a job portal.	4
8	Visualize weather data using Matplotlib/Seaborn.	5
9	Store and retrieve objects using pickle.	3
10	Build a SQLite-based task manager with a command-line interface.	5
11	Develop a Flask app that accepts user input and stores data in a database.	5
12	Write test cases for a Python application using pytest.	6

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 10 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 30 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.

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

Reference Books:

1. Mark Lutz – Learning Python, O'Reilly, 5th Edition
2. Luciano Ramalho – Fluent Python, O'Reilly, 2nd Edition
3. Wes McKinney – Python for Data Analysis, O'Reilly

Text Books:

1. Python Cookbook by David Beazley and Brian K. Jones
2. Effective Python by Brett Slatkin
3. Automate the Boring Stuff with Python by Al Sweigart

Useful Links:

1. NPTEL – Python for Data Science
2. NPTEL – Programming in Python

Bachelor of Engineering

in

Artificial Intelligence and Machine Learning

Fourth Year

Semester – VII

SJCEM R–24(Scheme-B)

Effective from Academic Year 2025-26

Program Structure for Fourth Year Artificial Intelligence and Machine Learning

(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24AIMLPCC701B	PCC	Deep Learning	3	-	2	3	-	1	4
24AIMLPCC702B	PCC	Big Data Analytics	3	-	2	3	-	1	4
24AIMLPEC701XB	PEC	Department Level Optional Course 3	3	-	2	3	-	1	4
24AIMLPEC702XB	PEC	Department Level Optional Course 4	3	-	2	3	-	1	4
24ILO701XB	OE	Institute Level Optional Course 1	3	-	-	3	-	-	3
24AIMLAEC701B	AEC	Corporate Communication & Employability Skills - II	-	-	2	-	-	1	1
24AIMLPRJ701B	PRJ	Major Project 1	-	-	4	-	-	2	2
		Total	**15**	**0**	**14**	**15**	**0**	**7**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA (TW)	OR/PR	Total
24AIMLPCC701B	PCC	Deep Learning	20	20	60	25	25	150
24AIMLPCC702B	PCC	Big Data Analytics	20	20	60	25	25	150
24AIMLPEC701XB	PEC	Department Level Optional Course 3	20	20	60	25	-	125
24AIMLPEC702XB	PEC	Department Level Optional Course 4	20	20	60	25	-	125
24ILO701B	OE	Institute Level Optional Course 1	20	20	60	-	-	100
24AIMLAEC701B	AEC	Corporate Communication & Employability Skills - II	-	-	-	25	-	25
24AIMLPRJ701B	PRJ	Major Project 1	-	-	-	25	25	50
		Total	**100**	**100**	**300**	**150**	**75**	**725**

Syllabus for

Fourth Year

Artificial Intelligence and Machine Learning

Semester – VII

SJCEM R–24 (Scheme-B)

(With Effect from 2025-2026)

Course Title: Deep Learning												
Semester: VII			**Term:** Odd			**Course Code:** 24AIMLPCC701B						
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	25	150

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

Course Objectives:

1. To learn the fundamentals of Neural Network.
2. To gain an in-depth understanding of training Deep Neural Networks.
3. To acquire knowledge of advanced concepts of Convolution Neural Networks, Autoencoders and Recurrent Neural Networks.
4. Students should be familiar with the recent trends in Deep Learning.

Course Outcomes:

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

1. Gain basic knowledge of Neural Networks.
2. Acquire in depth understanding of training Deep Neural Networks.
3. Design appropriate DNN model for supervised, unsupervised and sequence learning applications.
4. Gain familiarity with recent trends and applications of Deep Learning.

Module		**Contents**	**Hours**	**COs**
I		**Fundamentals of Neural Network**	6	CO1
	1.1	History of Deep Learning, Deep Learning Success Stories, Multilayer Perceptron (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feedforward Neural Networks, Representation Power of Feedforward Neural Networks		
	1.2	Deep Networks: Three Classes of Deep Learning Basic Terminologies of Deep Learning **Self-learning Topics:** Components of Neural Network, Applications of Neural Networks		
II		**Training, Optimization and Regularization of Deep Neural Network**	12	CO2
	2.1	**Training Feedforward DNN** Multi Layered Feed Forward Neural Network, Learning Factors, Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU, Loss functions: Squared Error loss, Cross Entropy, Choosing output function and loss function		
	2.2	**Optimization**		

		Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp		
	2.3	**Regularization** Overview of Overfitting, Types of biases, Bias Variance Trade-off Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight Decay, Batch normalization, Early stopping, Data Augmentation, Adding noise to input and output **Self-learning Topics:** Advanced Optimization Algorithms, Regularization Techniques		
III		**Autoencoders: Unsupervised Learning**	7	CO3
	3.1	Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders		
	3.2	Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders		
	3.3	Application of Autoencoders: Image Compression **Self-learning Topics:** Structure of Autoencoders, Application of Autoencoder: Image Denoising		
IV		**Convolutional Neural Networks (CNN): Supervised Learning**	8	CO3
	4.1	Convolution operation, Padding, Stride, Relation between input, output and filter size, CNN architecture: Convolution layer, Pooling Layer, Weight Sharing in CNN, Fully Connected NN vs CNN, Variants of basic Convolution function, Multichannel convolution operation, 2D convolution.		
	4.2	Modern Deep Learning Architectures: LeNET: Architecture, AlexNET: Architecture, ResNet : Architecture **Self-learning Topics:** Evaluation Metrics, Applications of CNNs		
V		**Recurrent Neural Networks (RNN)**	8	CO4
	5.1	Sequence Learning Problem, Unfolding Computational graphs, Recurrent Neural Network, Bidirectional RNN, Backpropagation Through Time (BTT), Limitation of " vanilla RNN" Vanishing and Exploding Gradients, Truncated BTT		
	5.2	Long Short Term Memory(LSTM): Selective Read, Selective write, Selective Forget, Gated Recurrent Unit (GRU) **Self-learning Topics:** RNN Architectures, Applications of RNNs		
VI		**Recent Trends and Applications**	4	CO4

	6.1	Generative Adversarial Network (GAN): Architecture		
	6.2	Applications: Image Generation, DeepFake **Self-learning Topics:** Discriminator Architecture, Training Dynamics		
		Total	45	

Exp. No.	List of Experiments	COs
1	**Based on Module 1 using Virtual Lab**	CO1
	1. Implement Multilayer Perceptron algorithm to simulate XOR gate. 2. To explore python libraries for deep learning e.g. Theano, TensorFlow etc.	
2	**Module 2 (Any Two)**	CO2
	1. Apply any of the following learning algorithms to learn the parameters of the supervised single layer feed forward neural network. a. Stochastic Gradient Descent b. Mini Batch Gradient Descent c. Momentum GD d. Nestorev GD e. Adagrad GD f. Adam Learning GD 2. Implement a backpropagation algorithm to train a DNN with at least 2 hidden layers. 3. Design and implement a fully connected deep neural network with at least 2 hidden layers for a classification application. Use appropriate Learning Algorithm, output function and loss function.	
3	**Module 3 (Any One)**	CO3
	1. Design the architecture and implement the autoencoder model for Image Compression. 2. Design the architecture and implement the autoencoder model for Image denoising.	
4	**Module 4 (Any One)**	CO3
	1. Design and implement a CNN model for digit recognition application. 2. Design and implement a CNN model for image classification.	
5	**Module 5 (Any Two)**	CO4
	1. Design and implement LSTM model for handwriting recognition, speech recognition, machine translation, speech activity detection, robot control, video games, time series forecasting etc. 2. Design and implement GRU for any real life applications, chat bots etc. 3. Design and implement RNN for classification of temporal data , sequence to sequence data modelling etc.	

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. Deep Learning from Scratch: Building with Python from First Principles- Seth Weidman by O`Reilley
2. François Chollet. Deep learning with Python (Vol. 361). 2018 New York: Manning.
3. Douwe Osinga. Deep Learning Cookbook, O'REILLY, SPD Publishers, Delhi.
4. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc
5. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, MIT Press Ltd, 2016
2. Li Deng and Dong Yu, Deep Learning Methods and Applications, Publishers Inc.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.
4. JM Zurada Introduction to Artificial Neural Systems, Jaico Publishing House

5. M. J. Kochenderfer, Tim A. Wheeler. Algorithms for Optimization, MIT Press.

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 : Big Data Analytics													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCC702B						
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	2	20	60	25	25	150

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

Course Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce programming skills to build simple solutions using big data technologies such as MapReduce and scripting for NoSQL, and the ability to write parallel algorithms for multiprocessor execution
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. To enable students to have skills that will help them to solve complex real-world problems in decision support.
5. To provide an indication of the current research approaches that is likely to provide a basis for tomorrow's solutions.

Course Outcomes:

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

1. Understand the key issues in big data management and its associated applications for business decisions and strategy.
2. Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop, Map reduce and NoSQL in big data analytics.
3. Collect, manage, store, query and analyze various forms of Big Data.
4. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
5. Adapt adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
6. Solve Complex real world problems in various applications like recommender systems, social media applications, health and medical systems, etc.

Module		Contents	Hours	COs
I		**Introduction to Big Data & Hadoop**	6	CO1
	1.1	Introduction to Big Data,		
	1.2	Big Data characteristics, types of Big Data,		
	1.3	Traditional vs. Big Data business approach,		
	1.4	Case Study of Big Data Solutions.		
	1.5	Concept of Hadoop		
	1.6	Core Hadoop Components; Hadoop Ecosystem		

		Self-learning Topics: History and evolution of Hadoop, Advantages of using Hadoop for Big Data processing		
II		**Hadoop HDFS and Map Reduce**	10	CO2
	2.1	Distributed File Systems: Physical Organization of Compute Nodes, Large-Scale File-System Organization.		
	2.2	MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures.		
	2.3	Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce		
	2.4	Hadoop Limitations. **Self-learning Topics:** Hadoop Ecosystem, Streaming		
III		**NoSQL**	6	CO3
	3.1	Introduction to NoSQL, NoSQL Business Drivers,		
	3.2	NoSQL Data Architecture Patterns: Key-value stores, Graph stores, Column family (Bigtable)stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study		
	3.3	Application of Autoencoders: Image Compression NoSQL solution for big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; NoSQL systems to handle big data problems. peer-to-peer; Four ways that NoSQL systems handle big data problems **Self-learning Topics:** Data Consistency Models, Types of NoSQL Database		
IV		**Mining Data Streams**	8	CO4
	4.1	The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data techniques in a Stream		
	4.2	Sampling Data techniques in a Stream		
	4.3	Filtering Streams: Bloom Filter with Analysis.		
	4.4	Counting Distinct Elements in a Stream, Count-Distinct Problem, Flajolet-Martin Algorithm, Combining Estimates, Space Requirements		
	4.5	Counting Frequent Items in a Stream, Sampling Methods for Streams, Frequent Itemsets in Decaying Windows.		
	4.6	Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm, Decaying Windows. Finding Similar Items and Clustering **Self-learning Topics:** Stream Data Processing Techniques, Feature Selection and Dimensionality Reduction		

V		**Finding Similar Items and Clustering**	5	CO5
	5.1	Distance Measures: Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance.		
	5.2	Long Short Term Memory(LSTM): Selective Read, Selective write, Selective Forget, Gated Recurrent Unit (GRU)CURE Algorithm, Stream-Computing , A Stream-Clustering Algorithm, Initializing & Merging Buckets, Answering Queries. **Self-learning Topics:** Vector Space Models (VSM), Latent Semantic Analysis (LSA)		
VI		**Real-Time Big Data Models**	10	CO6
	6.1	PageRank Overview, Efficient computation of PageRank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector.		
	6.2	A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering.		
	6.3	Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities in a social graph. **Self-learning Topics:** Stream Processing Frameworks, Real- time Analytics		
		Total	45	

Exp. No.	**List of Experiments**	COs
1.	Hadoop HDFS Practical: -HDFS Basics, Hadoop Ecosystem Tools Overview. -Installing Hadoop. -Copying File to Hadoop. -Copy from Hadoop File system and deleting file. -Moving and displaying files in HDFS. -Programming exercises on Hadoop.	CO1,2
2.	Use of Sqoop tool to transfer data between Hadoop and relational database servers. a. Sqoop - Installation. b. To execute basic commands of Hadoop eco system component Sqoop.	CO1,2
3.	To install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands.	CO1,3
4.	Experiment on Hadoop Map-Reduce / PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication, Aggregates, Joins, Sorting, Searching, etc.	CO1,2
5.	Create HIVE Database and Descriptive analytics-basic statistics, visualization using Hive/PIG/R.	CO3
6.	Write a program to implement word count programs using MapReduce.	CO2
7.	Implementing DGIM algorithm using any Programming Language/ Implement Bloom Filter using any programming language.	CO4
8.	Implementing any one Clustering algorithm (K-Means/CURE) using Map-Reduce.	CO4

9.	Streaming data analysis – use flume for data capture, HIVE/PYSpark for analysis of twitter data, chat data, weblog analysis etc.	CO5
10.	Implement PageRank using Map-Reduce.	CO6
11.	Implement predictive Analytics techniques (regression / time series, etc.) using R/ Scilab/ Tableau/ Rapid miner.	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:

Bill Franks , Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics, Wiley

1. Chuck Lam, Hadoop in Action, Dreamtech Press
2. Jared Dean, Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners, Wiley India Private Limited, 2014.
3. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, 3rd ed, 2010.
4. Lior Rokach and Oded Maimon, Data Mining and Knowledge Discovery Handbook, Springer, 2nd edition, 2010.
5. Ronen Feldman and James Sanger, The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data, Cambridge University Press, 2006.
6. Vojislav Kecman, Learning and Soft Computing, MIT Press, 2010

Text Books:

1. Anand Rajaraman and Jeff Ullman, Mining of Massive Datasets, Cambridge University Press,
2. Alex Holmes, Hadoop in Practice, Manning Press, Dreamtech Press.
3. Dan Mcary and Ann Kelly, Making Sense of NoSQL – A guide for managers and the rest of us, Manning Press.

Useful Links

1. https://nptel.ac.in/courses/117/102/117102062/
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=305
3. https://nptel.ac.in/courses/106/106/106106167/

Course Title : Natural Language Processing													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7011B						
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		-	1	4	20	2	0	60	25	-	25

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

Course Objectives:

1. To understand natural language processing and to learn how to apply basic algorithms in this field
2. To get acquainted with the basic concepts and algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. To design and implement various language models and POS tagging techniques
4. To design and learn NLP applications such as Information Extraction, Question answering
5. To design and implement applications based on natural language processing

Course Outcomes:

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

1. To have a broad understanding of the field of natural language processing
2. To design language model for word level analysis for text processing
3. To design various POS tagging techniques
4. To design, implement and test algorithms for semantic analysis
5. To develop basic understanding of Pragmatics and to formulate the discourse segmentation and anaphora resolution
6. To apply NLP techniques to design real world NLP applications

Module		Contents	Hours	COs
I		**Introduction**	5	CO1
	1.1	Origin & History of NLP, The need of NLP, Generic NLP System, Levels of NLP, Knowledge in Language Processing, Ambiguity in Natural Language, Challenges of NLP, Applications of NLP. **Self-learning Topics:** Applications of NLP, NLP Libraries and Tools		
II		**Word Level Analysis**	5	CO2
	2.1	Tokenization, Stemming, Segmentation, Lemmatization, Edit Distance, Collocations, Finite Automata, Finite State Transducers (FST), Porter Stemmer, Morphological Analysis, Derivational and Reflectional Morphology, Regular expression with types.		

	2.2	N –Grams, Unigrams/Bigrams Language Models, Corpora, Computing the Probability of Word Sequence, Training and Testing. **Self-learning Topics:** Lexical Analysis, Word Frequency Analysis		
III		**Syntax analysis**	9	CO3
	3.1	Part-Of-Speech Tagging (POS) - Open and Closed Words. Tag Set for English (Penn Treebank), Rule Based POS Tagging, Transformation Based Tagging, Stochastic POS Tagging and Issues –Multiple Tags & Words, Unknown Words.		
	3.2	Introduction to CFG, Hidden Markov Model (HMM), Maximum Entropy, And Conditional Random Field (CRF) **Self-learning Topics:** Context-Free Grammars (CFG), Parsing Techniques		
IV		**Semantic Analysis**	10	CO4
	4.1	The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data techniques in a Stream Introduction, meaning representation; Lexical Semantics; Corpus study; Study of Various language dictionaries like WordNet, Babelnet; Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy; Semantic Ambiguity		
	4.2	Word Sense Disambiguation (WSD); Knowledge based approach (Lesk's Algorithm), Supervised (Naïve Bayes, Decision List), Introduction to Semi-supervised method (Yarowsky), Unsupervised (Hyperlex) **Self-learning Topics:** Memory Management, Resource Management.		
V		**Pragmatic & Discourse Processing**	6	CO5
	5.1	Discourse: Reference Resolution, Reference Phenomena, Syntactic & Semantic constraint on coherence; Anaphora Resolution using Hobbs and Cantering Algorithm **Self-learning Topics:** Conversational implicature, Presupposition and accommodation		
VI		**Applications (preferably for Indian regional languages)**	5	CO6
	6.1	Machine Translation, Information Retrieval, Question Answers System, Categorization, Summarization, Sentiment Analysis, Named Entity Recognition.		
	6.2	Linguistic Modeling – Neurolinguistics Models- Psycholinguistic Models – Functional Models of Language – Research Linguistic Models- Common Features of		

		Modern Models of Language. **Self-learning Topics:** Language Learning Apps, Translation Apps		
		Total	45	

Exp. No.	List of Experiments	COs
1	Hadoop HDFS Practical: -HDFS Basics, Hadoop Ecosystem Tools Overview. -Installing Hadoop. -Copying File to Hadoop. -Copy from Hadoop File system and deleting file. -Moving and displaying files in HDFS. -Programming exercises on Hadoop. Study various applications of NLP and Formulate the Problem Statement for Mini Project based on chosen real world NLP applications: [Machine Translation, Text Categorization, Text summarization, Chat Bot, Plagiarism, Spelling & Grammar Checkers, Sentiment / Opinion analysis, Question answering, Personal Assistant, Tutoring Systems, etc.]	CO1
2	Apply various text preprocessing techniques for any given text: Tokenization and Filtration & Script Validation	CO2
3	Apply various other text preprocessing techniques for any given text: Stop Word Removal, Lemmatization / Stemming	CO2
4	Perform morphological analysis and word generation for any given text	CO4
5	Implement N-Gram model for the given text input	CO2
6	Study the different POS taggers and Perform POS tagging on the given text	CO3
7	Perform chunking by analyzing the importance of selecting proper features for training a model and size of training	CO4
8	Implement Named Entity Recognizer for the given text input	CO6
9	Implement Text Similarity Recognizer for the chosen text documents	CO6
10	Implement word sense disambiguation using LSTM/GRU	CO5
11	Exploratory data analysis of a given text (Word Cloud)	CO5
12	Mini Project Report: For any one chosen real world NLP application	CO6
13	Implementation and Presentation of Mini Project	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):
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C. Continuous Assessment (CA) :
Continuous Assessment should consist of the following

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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. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
2. Daniel M Bikel and ImedZitouni — Multilingual natural language processing applications: from theory to practice, IBM Press, 2013.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

Text Books:

1. Daniel Jurafsky, James H. and Martin, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
2. Christopher D.Manning and HinrichSchutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Useful Links

1. https://onlinecourses.nptel.ac.in/noc21_cs102/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs87/preview
3. https://nptel.ac.in/courses/106105158

Course Title : AI for Healthcare												
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7012B					
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

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

Course Objectives:

1. To understand the need and significance of AI and ML for Healthcare.
2. To study advanced AI algorithms for Healthcare.
3. To learn Computational Intelligence techniques .
4. To understand evaluation metrics and ethics in intelligence for Healthcare systems,
5. To learn various NLP algorithms and their application in Healthcare,
6. To investigate the current scope, implications of AI and ML for developing futuristic Healthcare Applications.

Course Outcomes:

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

1. Understand the role of AI and ML for handling Healthcare data.
2. Apply Advanced AI algorithms for Healthcare Problems.
3. Learn and Apply various Computational Intelligence techniques for Healthcare Application.
4. Use evaluation metrics for evaluating healthcare systems.
5. Develop NLP applications for healthcare using various NLP Techniques.
6. Apply AI and ML algorithms for building Healthcare Applications

Module		Contents	Hours	COs
I		**Introduction**	6	CO1
1.1	1.1	Overview of AI , ML and DL ,A Multifaceted Discipline, Applications of AI in Healthcare - Prediction, Diagnosis, personalized treatment and behaviour modification, drug discovery, follow-up care etc.		
	1.2	**Self-learning Topics:** Medical Imaging Analysis, Natural Language Processing (NLP) in Healthcare		
II		**AI, ML, Deep Learning and Data Mining Methods for Healthcare**	10	CO2
	2.1	Knowledge discovery and Data Mining, ML, Multi classifier Decision Fusion, Ensemble Learning, Meta-Learning and other Abstract Methods.		
	2.2	Evolutionary Algorithms, Illustrative Medical Application-Multiagent Infectious Disease Propagation and Outbreak		

		Prediction, Automated Amblyopia Screening System etc.		
	2.3	Computational Intelligence Techniques, Deep Learning, Unsupervised learning, dimensionality reduction algorithms. **Self-learning Topics:** Predictive Analytics in Healthcare, Natural Language Processing (NLP) for Healthcare		
III		**Evaluating learning for Intelligence**	6	CO3
	3.1	Model development and workflow, evaluation metrics, Parameters and Hyperparameters, Hyperparameter tuning algorithms, multivariate testing, Ethics of Intelligence. **Self-learning Topics:** Cognitive Psychology, Creative Thinking		
IV		**Natural Language Processing in Healthcare**	8	CO4
	4.1	NLP tasks in Medicine, Low-level NLP components, High level NLP components, NLP Methods.		
	4.2	Clinical NLP resources and Tools, NLP Applications in Healthcare. Model Interpretability using Explainable AI for NLP applications. **Self-learning Topics:** Medical Coding Automation, Patient Question Answering Systems		
V		**Intelligent personal Health Record**	5	CO5
	5.1	Introduction, Guided Search for Disease Information, Recommending SCA's. Recommending HHP's , Continuous User Monitoring. **Self-learning Topics:** Technology Infrastructure, Data Security and Privacy		
VI		**Future of Healthcare using AI**	10	CO6
	6.1	Evidence based medicine, Personalized Medicine, Connected Medicine, Digital Health and Therapeutics, Conversational AI, Virtual and Augmented Reality, Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals, Case Studies on use of AI and ML for Disease Risk Diagnosis from patient data, Augmented reality applications for Junior doctors.		
	6.2	Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals, Case Studies on use of AI and ML for Disease Risk Diagnosis from patient data, Augmented reality applications for Junior doctors. **Self-learning Topics:** Clinical Decision Support Systems (CDSS), Medical Imaging and Diagnostics		
		Total	45	

Exp. No.	List of Experiments	COs
1	Collect, Clean, Integrate and Transform Healthcare Data based on specific disease.	CO1
2	Perform Exploratory data analysis of Healthcare Data.	CO1
3	AI for medical diagnosis based on MRI/X-ray data.	CO1,2
4	AI for medical prognosis .	CO1,2
5	Natural language Entity Extraction from medical reports.	CO3
6	Predict disease risk from Patient data.	CO4
7	Medical Reviews Analysis from social media data.	CO5
8	Explainable AI in healthcare for model interpretation.	CO6
9	Mini Project-Design and implement innovative web/mobile based AI application using Healthcare Data. (this needs to be implemented in group of 3-4 students)	CO5
10	Documentation and Presentation of Mini Project.	CO6

E. 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.

F. End Semester Theory Examination (ESE):

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

G. 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.

H. Oral & Practical Exam

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

I. 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.

J. End Semester Theory Examination (ESE):

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

K. 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.

L. Oral & Practical Exam

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

Reference Books:

1. Erik R. Ranschaert Sergey Morozov Paul R. Algra, "Artificial Intelligence in medical Imaging- Opportunities, Applications and Risks", Springer
2. Sergio Consoli Diego Reforgiato Recupero Milan Petković,"Data Science for Healthcare- Methodologies and Applications", Springer
3. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp, Gia Nhu Nguyen, "Emerging technologies for health and medicine", Wiley.
4. Ton J. Cleophas Aeilko H. Zwinderman, "Machine Learning in Medicine-Complete Overview", Springer

Text Books:

3. Arjun Panesar, "Machine Learning and AI for Healthcare", A Press.
4. Arvin Agah, "Medical applications of Artificial Systems ", CRC Press

Useful Links

6. https://www.coursera.org/learn/introduction-tensorflow?specialization=tensorflow-in-practice
7. https://www.coursera.org/learn/convolutional-neural-networks-tensorflow?specialization=tensorflow- in-practice
8. https://datarade.ai/data-categories/electronic-health-record-ehr-data
9. https://www.cms.gov/Medicare/E-Health/EHealthRecords
10. https://www.coursera.org/learn/tensorflow-sequences-time-series-and-prediction?specialization=tensorflow-in-practice

Course Title : Neural Network & Fuzzy System													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7013B						
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. To relate to the basic terminologies with respect to Fuzzy set theory.
2. To analyze and interpret fuzzy logic principles, relations and operations.
3. To recognize various components of Associative Memory Networks.
4. To have basic understanding of Unsupervised learning through Networks.
5. To understand Special networks and its applications in soft computing.
6. To infer the significance of Hybrid computing.

Course Outcomes:

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

1. Acquire basic knowledge of fuzzy set theory properties and relations.
2. Implement Fuzzy operations towards Fuzzy-rule creations.
3. Gain familiarity with the training and implementation of Associative Memory Network.
4. Understand the architecture and basics components of Unsupervised learning networks.
5. Analyze the significance and working of the Special Networks.
6. Interpret Hybrid System to analyze the Principles of Soft computing in Neuro-Fuzzy applications.

Module		**Contents**	**Hours**	**COs**
I		**Fuzzy Set Theory**	8	CO1
	1.1	**Introduction to soft and hard computing Fuzzy Sets:** Basic definition and terminology of fuzzy sets, Classic set operations; Fuzzy set operations- Union, Intersection, complement, Difference; Properties of fuzzy sets.		
	1.2	**Fuzzy relations:** Cartesian product of relation, Classica Relation, Cardinality of fuzzy relations, Operations on Fuzzy relations, Properties of Fuzzy relations, Fuzzy composition, Tolerance and Equivalence Relationship.		
	1.3	**Membership Functions:** Features of Membership Functions, Fuzzification, Methods of membership value assignments. **Self-learning Topics:** Fuzzy set operations, Applications of Fuzzy Sets		
II		**Fuzzy Rules, Reasoning, and Inference System**		

		Lambda-Cuts for Fuzzy Sets; Lambda-Cuts for Fuzzy Relations; Defuzzification methods: Max-Membership Principles, Centroid Method, Weighted Average Method, Mean-Max Membership, Center of Sums, Center of Largest Area, First of Maxima. Abstract Methods.	10	CO2
	2.2	**Fuzzy Arithmetic and Rules:** Fuzzy arithmetic, Fuzzy measures, Measures of Fuzziness, Truth Value and Tables in Fuzzy Logic, Fuzzy Propositions, Formation of rules, Decomposition of rules, Fuzzy Reasoning.		
	2.3	**Fuzzy Inference System (FIS):** Mamdani FIS, Sugeno FIS, Comparison between Mamdani and Sugeno FIS. **Self-learning Topics:** Fuzzy Inference Methods, Inference Mechanisms		
III		**Associative Memory Networks**	7	CO3
	3.1	**Introduction:** Basics of associative memory networks, Training algorithms for Pattern Association.		
	3.2	**Types of Networks:** Radial basis function network : architecture training algorithm, Auto-associative Memory Network – Architecture, Flowchart of training process, Training algorithm, Testing algorithm, Hetero- associative Memory Network- Architecture and Testing algorithm, Bidirectional Associative Memory(BAM) Network- Architecture, Discrete BAM, Continuous BAM. **Self-learning Topics:** Architectures of Associative Memory Networks, Hopfield Networks		
IV		**Unsupervised Learning Networks**	8	CO4
	4.1	**Introduction** Fixed weight competitive nets, Maxnet, Maxican net, Hamming Network		
	4.2	**Kohonen Self- Organizing Feature Maps:** Basic concepts, Architecture, Flowchart, Algorithms, Kohonen Self-Organizing Motor map Training algorithm.		
	4.3	**Adaptive resonance Theory:** Architecture, Fundamental Operating principles, a Algorithms, Adaptive Resonance Theory I – Architecture, Flowchart of Training process, Training algorithm, Adaptive Resonance Theory 2 -Architecture, Algorithm, Flowchart, Training algorithm, Sample Values of Parameter. **Self-learning Topics:** Density-based clustering		

		(DBSCAN), Gaussian Mixture Models (GMM)		
V		**Special Network**		
	5.1	**Introduction:** Boltzmann Machine, Gaussian Machine, Probabilistic neural nets Spatio-Temporal connection network model, Ensemble neural model Extreme learning machine models, Online, Pruned, Improved Application of ELM **Self-learning Topics:** Applications of special networks.	6	CO5
VI		**Hybrid Computing**		
	6.1	**Neuro-Fuzzy Hybrid Systems:** Introduction to Neuro-Fuzzy systems, Comparison of Fuzzy systems and Neural networks, Characteristics of Neuro-Fuzzy systems, Classification of Neuro-Fuzzy systems. Introduction to Adaptive Neuro-Fuzzy Inference System (ANIFS), ANFS Architecture, Constraints of ANFIS, ANFIS as a Universal Approximator. **Self-learning Topics:** Blockchain Networks, Edge Computing Networks	6	CO6
		Total	45	

Exp. No.	**List of Experiments**	COs
1	Demonstrate Union and intersection of two Fuzzy Sets.	CO1
2	Demonstrate difference between two Fuzzy Sets.	CO1
3	Implement Fuzzy membership functions.	CO1, 2
4	Implement Fuzzy Inference system (FIS).	CO1, 2
5	Implement any De-fuzzification of membership method.	CO2
6	Implement Bidirectional Associative Memory(BAM) Network	CO3
7	Implement Radial basis function network.	CO3
8	Implement Basic Neural Network learning rules.	CO3, 4
9	Implement any Unsupervised Learning algorithm.	CO4
10	Implement Kohonen Self- Organizing Feature Maps	CO4
11	Implement a Probabilistic Neural Network.	CO5
12	Implement any Ensemble neural model.	CO5, 6
13	Design any one Neuro-Fuzzy system.	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:

12. Anupam Shukla, Ritu Tiwari, Rahul Kala, Real Life Applications of Soft Computing, CRC Press, Taylor & Francis Group, 2010.
13. Genetic Algorithms and Genetic Programming Modern Concepts and Practical Applications © 2009 Michael Affenzeller, Stephan Winkler, Stefan Wagner, and Andreas Beham, CRC Press
14. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Pearson

Text Books:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007, ISBN10: 81- 265-1075-7.
2. J.-S. R. Jang, C. –T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence, PHI Learning Private Limited-2014
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004/2007
4. Simon Haykin, Neural Networks A Comprehensive Foundation, Second Edition, Pearson Education-2004

5. David E. Goldberg, Genetic Algorithms, in search, optimization and Machine Learning, Pearson

Useful Links

https://onlinecourses.nptel.ac.in/noc22_ee21/preview
https://onlinecourses.nptel.ac.in/noc23_ge15/previe

Course Title : User Experience Design with VR													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7021B						
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	2	20	60	25	-	125

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

Course Objectives:

1. To study and understand importance of user experience design principles
2. To understand elements of user experience design
3. To encourage students to participate in designing futuristic applications
4. To understand the need and significance of Virtual Reality
5. To understand the technical and engineering aspects of virtual reality system

Course Outcomes:

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

1. To Apply principles of user experience
2. To apply emerging and established technologies to enhance User Experience design
3. To create interface for international standards with ethics
4. To evaluate user experience.
5. Describe how VR systems work and list the applications of VR
6. Design and implementation of the hardware that enables VR systems to be built

Module		**Contents**	**Hours**	**COs**
I		**Introduction**		
	1.1	Introduction to interface design, Understanding and conceptualizing Interface, understanding user's conceptual cognition, Core Elements of User Experience, Working of UX elements **Self-learning Topics:** Information Architecture, Interaction Design	5	CO1
II		**The UX Design Process – Understanding Users & Structure:**		
2.1		Defining the UX, Design Process and Methodology, Understanding user requirements and goals, Understanding the Business Requirements/Goals, User research, mental models, wireframes, prototyping, usability testing.		

2.2		Visual Design Principles , Information Design and Data Visualization Interaction Design, UI Elements and Widgets, Screen Design and Layouts **Self-learning Topics:** User Research Methods, Content Strategy	8	CO2
III		**UX Design Process: Prototype and Test**		
	3.1	Testing your Design, Usability Testing, Types of Usability Testing , Usability Testing Process, Preparing and planning for the Usability Tests,	8	CO3
	3.2	Prototype your Design to Test, Introduction of prototyping tools, conducting Usability Test, communicating Usability Test Results **Self-learning Topics:** Low-Fidelity Prototyping, High-Fidelity Prototyping		
IV		**UX Design Process: Iterate/ Improve and Deliver**		
	4.1	Understanding the Usability Test, findings, Applying the Usability Test, feedback in improving the design.	6	CO4
	4.2	Communication with implementation team. UX Deliverables to be given to implementation team **Self-learning Topics:** User Feedback Integration, Usability Testing		
V		**Introduction to Virtual Reality**		
	5.1	Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality	10	CO5
	5.2	Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR **Self-learning Topics:** Fundamentals of Virtual Reality, Applications of Virtual Reality		
VI		**Applying Virtual Reality**		
	6.1	Virtual reality: the medium, Form and genre, What makes an application a good candidate for VR, Promising application fields, Demonstrated benefits of virtual reality, More recent trends in virtual reality application development, A framework for VR application development **Self-learning Topics:** VR Content Creation, Future Trends and Predictions	8	CO6
		Total	45	

Exp. No.	List of Experiments	COs
1	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.	CO1, 5
2	Demonstrate difference between two Fuzzy Sets. Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.	CO1, 2
3	Develop a scene in Unity that includes: i. a cube, plane and sphere, apply transformations on the 3 game objects. ii. add a video and audio source	CO1, 2
4	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click	CO2
5	Develop a scene in Unity that includes a sphere and plane . Apply Rigid body component, material and Box collider to the game Objects. Write a C# program to grab and throw the sphere using vr controller.	CO2, 3
6	Develop a simple UI(User interface) menu with images, canvas, sprites and button. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction displays a score on scene .	CO2, 4
7	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models	CO4, 5
8	Include animation and interaction in the immersive environment created in Assignment 7.	CO5
9	Case Study/Mini Project: Create a virtual environment for any use case. The application must include at least 4 scenes which can be changed dynamically, a good UI, animation and interaction with game objects. (e.g. VR application to visit a zoo)	CO6
10	Presentation of Mini Project	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 Elements of User Experience by Jesse James Garrett
2. Don't make me think, by Steve Krug
3. Observing the User Experience: A Practitioner's Guide to User Research by Mike Kuniavsky

Text Books:

1. Interaction Design, Beyond Human Computer Interaction, Rogers, Sharp, Preece Wiley India Pvt Ltd.
2. The essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin
3. Designing The user Interface by Shneiderman, Plaisant, Cohen, Jacobs Pearson

Useful Links

1. https://archive.nptel.ac.in/courses/124/107/124107008/
2. https://nptel.ac.in/courses/106106138
3. https://www.coursera.org/specializations/virtual-reality

Course Title : Block chain Technologies												
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7022B					
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. 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 Special networks and its applications in soft computing.
6. To understand different types of crypto assets.

Course Outcomes:

At the end 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		Contents	Hours	COs
I		**Introduction to Blockchain**	6	CO1
	1.1	**Distributed Ledger Technologies:** Introduction to blockchain: History, evolution, fundamentals concepts, components, types. **Block in a Blockchain:** Structure of a Block, Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Tree. **Self-learning Topics:** Structure of a Block, Block Size and Capacity		
II		**Consensus Protocol and Bitcoin blockchain**	8	CO2
	2.1	**Consensus:** Byzantine Generals Problem, consensus algorithms: PoW, PoS, PoET, PoA, LPoS, pBFT, Proof-of-Burn (PoB), Life of a miner, Mining difficulty, Mining pool and its methods.		
	2.2	**Bitcoin:** What is Bitcoin, history of Bitcoin, Bitcoin		

		Common minologies: keys, addresses and nodes, Bitcoin mining, hashcash, Block propagation and relay, bitcoin scripts, transaction in the bitcoin network. **Self-learning Topics:** Proof of Work (PoW), Mining Rewards		
III		**Ethereum and Smart Contracts**	10	CO3
	3.1	**Ethereum:** History, Components, Architecture of Ethereum, Consensus, Miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, Accounts, Patricia Merkle Tree, Swarm, Whisper and IPFS, complete transaction working and steps in Ethereum, Case study of Ganache for Ethereum blockchain. Exploring etherscan.io and ether block structure, Comparison between Bitcoin and Ethereum		
	3.2	**Smart Contracts:** history, characteristics, working of smart contracts, types, Oracles, Structure & Limitations. **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. Smart Contracts Use cases, Opportunities and Risk. **Self-learning Topics:** Ethereum Virtual Machine (EVM), Smart Contracts Basics		
IV		**Private and Consortium blockchains**	9	CO4
	4.1	**Introduction to Private Blockchain:** Key characteristics, need, Examples of Private and Consortium blockchains, Smart contracts in private blockchain.		
	4.2	Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric, Comparison between Hyperledger Fabric & Other Technologies. Hyperledger Platform, Paxos and Raft consensus, Ripple and Corda blockchains, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT. **Self-learning Topics:** Introduction to Private and Consortium Blockchains, Use Cases of Private and Consortium Blockchains		
V		**Cryptocurrencies and digital tokens**	6	CO5
	5.1	Cryptocurrency basics, types, usage, ERC20 and ERC721 Tokens, comparison between ERC20 & ERC721, ICO: basics and related terms, launching an ICO, pros and cons, evolution and platforms, STO, Different Crypto currencies, Defi, Metaverse, Types of cryptocurrencies. Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem **Self-learning Topics:** Cryptocurrency Trading and		

		Investing, Regulatory Environment.		
VI		**Blockchain applications, Tools and case studies**	6	CO6
	6.1	**Applications of Blockchain:** Various domains including Education, Energy, Healthcare, real-estate, logistics, supply chain. Tools: Corda, Ripple, Quorum and other Emerging Blockchain Platforms, Case Study on any of the Blockchain Platforms. **Self-learning Topics:** Blockchain Case Studies: Walmart's Food Traceability, Analyze Walmart's use of blockchain to track the provenance of food items		
		Total	45	

Exp. No.	List of Experiments	COs
1	Demonstrate Union and intersection of two Fuzzy Sets. Local Blockchain: Introduction to Truffle, establishing local Block chain using Truffle a) Cryptography in Block chain and Merkle root tree hash	CO1
2	**Smart contracts and Chain code :** Solidity programming language, chain code (Java/JavaScript/Go), deployment on Truffle local a) Creating Smart Contract using Solidity b) Embedding wallet and transaction using Solidity	CO1,2
3	**Deployment and publishing smart contracts on Ethereum test network:** Ethereum Test networks (Ropsten/Gorelli/Rinkeby), deployment on test networks, Web3.js/Web3.py for interaction with Ethereum smart contract a) Blockchain platform Ethereum using Geth. b) Blockchain platform Ganache	CO3
4	**Remix IDE and Metamask:** Smart contract development and deployment using Meta mask and Remix. Design and develop Crypto currency	CO3
5	**Chain code deployment in Hyper ledger Fabric:** Chain code deployment in Hyper ledger fabric Mini project: Study required front end tools	CO4
6	Case Study on Hyper ledger	CO4
7	Case Study on Other Block chain platforms.	CO1
8	Creating a block chain Application	CO6
9	**Mini-project on Design and Development of a DApps using Ethereum/Hyperledger Fabric:** Implementation of Mini Project, 1. Design, configure and testing of mini project 2. Report submission as per guidelines 3. Implementation and Presentation of Mini Projects	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. 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.
4. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Antony Lewis. for Ethereum and Blockchain, Ritesh Modi, Packt publication. University of Mumbai, B. E. (Information Technology), Rev 2016 276

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. NPTEL courses: Blockchain and its Applications, Blockchain Architecture Design and Use Cases
2. https://ethereum.org/en/
3. https://www.trufflesuite.com/tutorials
4. https://hyperledger-fabric.readthedocs.io/en/release-2.2/
5. Blockchain demo: https://andersbrownworth.com/blockchain/
6. Blockchain Demo: Public / Private Keys & Signing: https://andersbrownworth.com/blockchain/

Course Title : Game Theory for Data Science													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPCE7023B						
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	2	20	60	25	-	125

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

Course Objectives:

1. To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
2. To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.
3. To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
4. To introduce contemporary topics in the intersection of game theory, computer science, and economics.
5. To apply game theory in searching, auctioning and trading.

Course Outcomes:

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

1. Analyze and Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.
2. Discuss the use of Nash Equilibrium for other problems. Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
3. Identify some applications that need aspects of Bayesian Games. Implement a typical Virtual Business scenario using Game theory.
4. Identify and discuss working principle of Non-Cooperative Games
5. Discuss the Mechanism for Design Aggregating Preferences
6. Identify and discuss working principle : Repeated Games

Module		Contents	Hours	COs
0	Prerequisite	Probability, Algebra	2	
I	Introduction:	Making rational choices: basics of Games – strategy – preferences – payoffs – Mathematical basics – Game theory – Rational Choice – Basic solution concepts-non-cooperative versus cooperative games – Basic computational issues – finding equilibria and learning in games Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets). Merkle Tree. **Self-learning Topics:** Probability Distributions, Statistical Inference	7	CO1
II	Games with Perfect Information:	Strategic games – prisoner's dilemma, matching pennies - Nash equilibria – theory and illustrations – Cournot's and Bertrand models of oligopoly – auctions – mixed strategy equilibrium – zero-sum games – Extensive Games with Perfect Information – repeated games (prisoner's dilemma) – subgame perfect Nash equilibrium; computational issues. **Self-learning Topics:** Game Theory, Classical Games	8	CO2
III	Games with Imperfect Information:	Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions – Information aspects – Illustrations – Extensive Games with Imperfect – Information – Strategies – Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner's Dilemma – Bargaining. **Self-learning Topics:** Strategic Interactions, Sequential Decision-Making	7	CO3
IV	Non-Cooperative Game Theory:	Non-cooperative Game Theory – Self-interested agents – Games in normal form – Analyzing games: from optimality to equilibrium – Computing Solution Concepts of Normal – Form Games – Computing Nash equilibria of two- player, zero-sum games –Computing Nash equilibria of two-player, general sum games – Identifying dominated strategies **Self-learning Topics:** Strategic Form Games, Extensive Form Games	8	CO4
	Mechanism Design Aggregating Preferences:	Social Choice – Formal Model – Voting – Existence of social functions – Ranking systems – Protocols for Strategic Agents: Mechanism Design – Mechanism design with unrestricted preferences – Efficient mechanisms – Vickrey and VCG mechanisms (shortest paths) –		

V		Combinatorial auctions – profit maximization Computational applications of mechanism design – applications in Computer Science –Google's sponsored search – eBay auctions – K-armed bandits. **Self-learning Topics:** Preference Aggregation Mechanisms, Bayesian Games	7	CO5
VI	Repeated Games	Blockchain applications, Tools and case studies Repeated games: The Prisoner's Dilemma , The main idea ,Preferences ,Infinitely repeated games, Strategies ,SomeNash equilibria of the infinitely repeated Prisoner's Dilemma , Nash equilibrium payoffs of the infinitely repeated Prisoner's Dilemma when the players are patient ,Subgame perfect equilibria and the one-deviation property **Self-learning Topics:** Strategies in Repeated Games, Learning in Repeated Games	6	CO6
		Total	45	

Exp. No.	**List of Experiments**	COs
1	Prisoners' dilemma	CO3,6
2	Pure Strategy Nash Equilibrium	CO4,6
3	Extensive Form – Graphs and Trees, Game Trees	CO1
4	Strategic Form – Elimination of dominant strategy	CO4
5	Minimax theorem, minimax strategies	CO4
6	Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium,	CO1
7	Imperfect-information games – Mixed Strategy Nash Equilibrium – Finding mixed-strategy Nash equilibria for zero sum games, mixed versus behavioural strategies.	CO4,6
8	Repeated Games	CO4
9	Bayesian Nash equilibrium	CO6
10	Implementation of any game for example Tic Tac To , coloring triangle , water jug , 8 queen , 8 puzzle etc (this should be done in group of 3-4)	CO4,6

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. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.
2. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani (Editors), Algorithmic Game Theory. Cambridge University Press, 2007.
3. A. Dixit and S. Skeath, Games of Strategy, Second Edition. W Norton & Co Inc, 2004.
4. Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press 2008.
5. Zhu Han, Dusit Niyato, WalidSaad, Tamer Basar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.
6. Y. Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

Text Books:

1. An Introduction to Game Theory by Martin J. Osborne
2. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2004

Useful Links

1. https://nptel.ac.in/courses/110104063
2. https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Course Title: Product Lifecycle Management												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7011B					
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 -	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives: Students will try:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Course Outcomes:

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Module	Contents	Hours	COs
I	**Introduction to Product Lifecycle Management (PLM):**Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	10	CO1
II	**Product Design:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering,	12	CO2

	Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for Tools, Choice of Design for X Tools and Their Use in the Design Process		
III	Product Data Management (PDM):Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	6	CO2
IV	Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	6	CO3
V	Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	6	CO3
VI	Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	5	CO4
	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.

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

1 John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105

2 Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229

3 Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN:3540257314

4 Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

Course Title: Reliability Engineering												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7012					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives: Students will try:

1. To familiarize the students with various aspects of probability theory
2. To acquaint the students with reliability and its concepts
3. To introduce the students to methods of estimating the system reliability of simple and complex systems
4. To understand the various aspects of Maintainability, Availability and FMEA procedure

Course Outcomes:

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

1. Understand and apply the concept of Probability to engineering problems
2. Apply various reliability concepts to calculate different reliability parameters
3. Estimate the system reliability of simple and complex systems
4. Carry out a Failure Mode Effect and Criticality Analysis

Module	Contents	Hours	COs
I	**Probability theory:** Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem. **Probability Distributions:** Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance. **Measures of Dispersion:** Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.	10	CO1
II	**Reliability Concepts:** Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve. **Failure Data Analysis:** Hazard rate, failure density, Failure Rate, Mean Time To Failure (MTTF), MTBF, Reliability Functions. Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.	10	CO2
III	System Reliability: System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex system	5	CO2
IV	**Reliability Improvement:** Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method,	8	CO3

	Success Path method, Decomposition method.		
V	**Maintainability and Availability:** System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects	6	CO3
VI	**Failure Mode, Effects and Criticality Analysis:** Failure mode effects analysis, severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fau1t tree analysis and Event tree Analysis	6	CO4
	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.

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

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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

1. L.S. Srinath, "Reliability Engineering", Affiliated East-Wast Press (P) Ltd., 1985.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw Hill.
3. B.S. Dhillion, C. Singh, "Engineering Reliability", John Wiley & Sons, 1980.
4. P.D.T. Conor, "Practical Reliability Engg.", John Wiley & Sons, 1985.
5. K.C. Kapur, L.R. Lamberson, "Reliability in Engineering Design", John Wiley & Sons.
6. Murray R. Spiegel, "Probability and Statistics", Tata McGraw-Hill Publishing Co. Ltd.

Course Title: Management Information System												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7013					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

Course Outcomes:

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

1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

Module	Contents	Hours	COs
I	Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS.	5	CO1
II	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management. Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	8	CO2
III	Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls	7	CO2
IV	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C.Mobile commerce	8	CO3
V	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	7	CO4

VI	Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.	10	CO5
	Total	45	

Evaluation and Assessment Scheme:

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

C. Continuous Assessment (CA) :
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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

1 Kelly Rainer, Brad Prince, Management Information Systems, Wiley

2 K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.

3 D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

Course Title: Design of Experiments												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7014					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

Course Outcomes:

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

1. Plan data collection, to turn data into information and to make decisions that lead to appropriate action
2. Apply the methods taught to real life situations
3. Plan, analyze, and interpret the results of experiments

Module	Contents	Hours	COs
I	**Introduction** Strategy of Experimentation Typical Applications of Experimental Design Guidelines for Designing Experiments Response Surface Methodology	7	CO1
II	**Fitting Regression Models** Linear Regression Models Estimation of the Parameters in Linear Regression Models Hypothesis Testing in Multiple Regression Confidence Intervals in Multiple Regression Prediction of new response observation Regression model diagnostic Testing for lack of fit	9	CO1
III	**Two-Level Factorial Designs** The 22 Design The 23 Design The General2k Design A Single Replicate of the 2k Design The Addition of Center Points to the 2k Design, Blocking in the 2k Factorial Design Split-Plot Designs	8	CO2
IV	**Two-Level Fractional** Factorial Designs The One-Half Fraction of the 2k Design The One Quarter Fraction of the 2k Design The General 2k-p Fractional Factorial Design Resolution III Designs Resolution IV and V Designs Fractional Factorial Split-Plot Designs	8	CO2

V	**Response Surface Methods and Designs** Introduction to Response Surface Methodology The Method of Steepest Ascent Analysis of a Second-Order Response Surface Experimental Designs for Fitting Response Surfaces	8	CO3
VI	**Taguchi Approach** Crossed Array Designs and Signal-to-Noise Ratios Analysis Methods Robust design examples	5	CO3
	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.

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
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1. Assignment
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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

1 Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001

2 D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley &Sons, New York,2001

3 George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley

4 W J Dimond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2

5 Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss

Course Title: Operation Research												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7015					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. Formulate a real-world problem as a mathematical programming model.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.

Course Outcomes:

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

1. Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
2. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
3. Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
4. Understand the applications of integer programming and a queuing model and compute important performance measures

Module	Contents	Hours	COs
I	**Introduction to Operations Research:** Introduction, , Structure of the Mathematical Model, Limitations of Operations Research **Linear Programming:** Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method, Duality, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis **Transportation Problem:** Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. **Assignment Problem:** Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem **Integer Programming Problem:** Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.	15	CO1
II	**Queuing models:** queuing systems and structures, single server and multi- server models, Poisson input, exponential service, constant rate service, finite and infinite population	6	CO1
III	**Simulation:** Introduction, Methodology of Simulation, Basic Concepts, 220 Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	6	CO2
IV	**Dynamic programming.** Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	6	CO3
V	**Game Theory.** Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	6	CO4
VI	**Inventory Models:** Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model,	6	CO4
	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.

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

Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.

Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009.

Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002

Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut

Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons.

Course Title: Cyber Security and Laws												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7016					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. To understand and identify different types cybercrime and cyber law
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

Course Outcomes:

1. At the end of the course students will be able to:
2. Understand the concept of cybercrime and its effect on outside world Interpret and apply IT law in various legal issues
3. Distinguish different aspects of cyber law
4. Apply Information Security Standards compliance during software design and development

Module	Contents	Hours	COs
I	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes	5	CO1
II	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	10	CO2
III	**Tools and Methods Used in Cyber line** Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	7	CO2
	The Concept of Cyberspace		

IV	E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law ,Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	9	CO3
V	**Indian IT Act.** Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	7	C04
VI	**Information Security Standard compliances** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	7	CO4
	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.

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

1 Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi

2 The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi

3 The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi

4 Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumba

5 Nina Godbole, Information Systems Security, Wiley India, New Delhi

6 Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.

7 William Stallings, Cryptography and Network Security, Pearson Publication

8 Websites for more information is available on : The Information Technology ACT, 2008-TIFR : https://www.tifrh.res.in

9 Website for more information , A Compliance Primer for IT professional : https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

Course Title: Disaster Management and Mitigation Measures												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7017					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. To understand physics and various types of disaster occurring around the world
2. To identify extent and damaging capacity of a disaster
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand role of individual and various organization during and after disaster
5. To understand application of GIS in the field of disaster management
6. To understand the emergency government response structures before, during and after disaster

Course Outcomes:

1. Get to know natural as well as man-made disaster and their extent and possible effects on the economy.
2. Plan of national importance structures based upon the previous history.
3. Get acquainted with government policies, acts and various organizational structure associated with an emergency.
4. Get to know the simple do's and don'ts in such extreme events and act accordingly.

Module	Contents	Hours	COs
I	**Introduction** 1.1 Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.	4	CO1
II	**Natural Disaster and Manmade disasters:** Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	10	CO2
III	**Disaster Management, Policy and Administration Disaster management:** meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and co- ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.	7	CO2
IV	**Institutional Framework for Disaster Management in India:** 4.1 Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management(NIDM) and National disaster management authority(NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. 4.2 Use of Internet and software for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard	7	CO3
V	**Financing Relief Measures:** Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events	10	CO4
VI	**Preventive and Mitigation Measures:** Pre-disaster, during disaster and post-disaster measures in some events in general Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids.	7	CO4
	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.

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

1 'Disaster Management' by Harsh K.Gupta, Universities Press Publications.

2 'Disaster Management: An Appraisal of Institutional Mechanisms in India' by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011

3 'Introduction to International Disaster Management' by Damon Copolla, Butterworth Heinemann Elseveir Publications.

4 'Disaster Management Handbook' by Jack Pinkowski, CRC Press Taylor and Francis group.

5 'Disaster management & rehabilitation' by Rajdeep Dasgupta, Mittal Publications, New Delhi.

6 'Natural Hazards and Disaster Management, Vulnerability and Mitigation – R B Singh, Rawat Publications

7 Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yonng – Prentice Hall (India) Publications. (Learners are expected to refer reports published at national and International level and updated information available on authentic web sites)

Course Title: Energy Audit and Management												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7018					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation.
2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Course Outcomes:

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Contents	Hours	COs
I	**Energy Scenario:** Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act- 2001 and its Features. Basics of Energy and its various forms, Material and Energy balance	9	CO1
II	**Energy Audit Principles:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)	7	CO2
III	**Energy Management and Energy Conservation in Electrical System:** Electricity billing, Electrical load management and maximum demand	8	CO3

	Control; Power factor improvement, Energy efficient equipment and appliances, star ratings. **Energy efficiency measures in lighting system, Lighting control:** Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.		
IV	**Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	5	CO4
V	**Energy Performance Assessment:** On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	11	CO5
VI	**Energy conservation in Buildings:** Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources	5	CO5
	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.

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 Receive
9. Mind Mapping
10. 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

Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science

Designing with light: Lighting Handbook, By Anil Valia, Lighting System

Energy Management Handbook, By W.C. Turner, John Wiley and Sons

Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).

Energy Management Principles, C.B.Smith, Pergamon Press

Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press

Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press

Course Title: Development Engineering												
Semester: VII			**Term:** Odd				**Course Code:** 24ILO7019					
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	-	-	3	-	-	3	20	20	60	-	-	100

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

Course Objectives:

1. To familiarise the characteristics of rural Society and the Scope, Nature and Constraints of rural Development
2. To provide an exposure to implications of 73rdCAA on Planning, Development and Governance of Rural Areas
3. An exploration of human values, which go into making a 'good' human being, a 'good' professional, a good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals
4. To familiarise the Nature and Type of Human Values relevant to Planning Institutions

Course Outcomes:

1. Demonstrate understanding of knowledge for Rural Development.
2. Prepare solutions for Management Issues.
3. Take up Initiatives and design Strategies to complete the task
4. Develop acumen for higher education and research.
5. Demonstrate the art of working in group of different nature
6. Develop confidence to take up rural project activities independently

Module	Contents	Hours	COs
I	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services	9	CO1
II	Post-Independence rural Development Balwant Rai Mehta Committee three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development	7	CO2
III	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring	8	CO3

	organizations and agencies; Urban and rural interface -integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development		
IV	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including – XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha – revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments	5	CO4
V	Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom	11	CO5
VI	Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education	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.

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

1 ITPI, Village Planning and Rural Development, ITPI, New Delhi

2 Thooyavan, K.R. Human Settlements: A 2005 MA Publication, Chennai

3 GoI, Constitution (73rdGoI, New Delhi Amendment) Act, GoI, New Delhi

4 Planning Commission, Five Year Plans, Planning Commission

5 Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi

6 Planning Guide to Beginners

7 Weaver, R.C., The Urban Complex, Doubleday

8 Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington

9 How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150

10 Watson, V. Conflicting Rationalities: -- Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395 – 407

Course Title: Corporate Communication & Employability Skills- II (CCES - II)													
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLAEC701						
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**								
--	--	02	--	--	01	01	--	--	--	25	--	25	

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

Course Objectives:

1. To apply required interpersonal skills so as to face challenges at the global level.
2. To equip students with relevant employment skills for their career advancement.

Course Outcomes:

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

1. Exhibit emotional intelligence by recognizing and responding appropriately to the emotions and perspectives of individuals from various cultural backgrounds.
2. Develop a comprehensive set of employability skills, including critical thinking, problem-solving, and adaptability, to navigate the evolving job market.

Tut No.	List of Tutorials	Hr.	CO
	Listening Skills		
1	IELTS Listening	**1**	**1**
2	Grooming, Dress and Appearance	**1**	**1**
	Speaking Skills		
3	Self-Introduction	**1**	**1**
4	Technical Presentation (External Evaluator)	**1**	**1**
5	Impromptu Speech	**1**	**1**
6	Group Discussion	**1**	**2**
7	Mock Interview (Panel/Online)	**2**	**2**
	Reading Skills		
8	Book Review	**2**	**2**
9	Crossword & News/Editorial Reading	**1**	**2**
	Writing Skills		
10	Proficiency Test	**1**	**2**
11	Resume Writing	**1**	**2**

12	Official Correspondence: Inquiry & Reply, Complaint & Adjustment	**1**	**2**

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. 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. Locker O Kitty & Kaczmarek Kyo Stephen, Business Communication Building Critical Skills, McGraw Hill Education Private Limited, 2007
8. Chaturvedi P D & Chaturvedi Mukesh, Business Communication Concepts, Cases and Applications, Pearson Education, 2008

Text Books:

1. Luthans Fred, Organizational Behavior An Evidence-Based Approach, McGraw Hill Education Private Limited, 2013

Useful Links:

- https://youtu.be/k9NMWDqun5A?si=HKOdK5PtKy6HvkBk
- https://youtu.be/waOIjlaTSo8?si=iHiCOT-KQRoJvFE3
- https://youtu.be/FfhZFRvmaVY?si=7NcRYuRBb0F6sfKf
- https://youtu.be/FVqSiFUVX78?si=-ZMO0_yT-Hl-5UW0
- https://youtu.be/6OdCoMgpx7o?si=iq2oK3auNRI1Z7D0

Course Title: Major Project 1												
Semester: VII			**Term:** Odd				**Course Code:** 24AIMLPRJ701					
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**							
-- -	-	4	--	--	02	02	--	--	--	25	25	50

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

Course Objectives:

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.

Course Outcomes:

At the end of the course, learner 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. Analyze the impact of solutions in societal and environmental context for sustainable development.
5. Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
6. Demonstrate project management principles during project work.

Guidelines:

1. Project Topic Selection and Allocation:

- Project topic selection Process to be defined and followed:
  - Project orientation can be given at the end of sixth semester.
  - Students should be informed about the domain and domain experts whose guidance can be taken before selecting projects.
  - Student's should be recommended to refer papers from reputed conferences/journals like IEEE, Elsevier, ACM etc. which are not more than 3 years old for review of literature.
  - Dataset selected for the project should be large and real-time
  - Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements. Students can be informed to refer Digital India portal, SIH portal or any other hackathon portal for problem selection.
- Topics can be finalized with respect to following criterion:
  - Topic Selection: The topics selected should be novel in nature (Product based, Application based or Research based) or should work towards removing the lacuna in currently existing systems.

- Technology Used: Use of latest technology or modern tools can be encouraged. AI, ML, DL, NNFS, NLP based algorithms can be implemented.
- Students should not repeat work done previously (work done in the last three years).
- Project work must be carried out by the group of at least 3 students and maximum 4.
- The project work can be undertaken in a research institute or organization/Industry/any business establishment. (out-house projects)
- The project proposal presentations can be scheduled according to the domains and should be judged by faculty who are expert in the domain.
- Head of department and senior staff along with project coordinators will take decision regarding final selection of projects.
- Guide allocation should be done and students have to submit weekly progress report to the internal guide.
- 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.
- In case of industry/ out-house projects, visit by internal guide will be preferred and external members can be called during the presentation at various levels

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.

A project report should preferably contain 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 Set up
- Details of Database or details about input to systems or selected data
- Performance Evaluation Parameters (for Validation)
- Software and Hardware Setup
- Implementation Plan for Next Semester
- Timeline Chart for Term1 and Term-II (Project Management tools can be used.)
- References

Desirable

Students can be asked to undergo some Certification course (for the technical skill set that will be useful and applicable for projects.)

3. Term Work:

Distribution of marks for term work shall be done based on following:

- Weekly Log Report
- Project Work Contribution
- Project Report (Spiral Bound) (both side print)
- Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

4. Oral and Practical:

Oral and Practical examination (Final Project Evaluation) of Project 1 should be conducted by Internal and External examiners approved by University of Mumbai at the end of the semester.

Suggested quality evaluation parameters are as follows:

- Quality of problem selected
- Clarity of problem definition and feasibility of problem solution
- Relevance to the specialization / industrial trends
- Originality
- Clarity of objective and scope
- Quality of analysis and design
- Quality of written and oral presentation
- Individual as well as teamwork