



Re- accredited with A ++ Grade (CGPA 3.65) by NAAC
Category- I University Status awarded by UGC

No.AAMS_UGS/ICC/2025-26/47

Date: 18th June, 2025

CIRCULAR :-

Attention of all the Principals of the Affiliated Colleges, Directors of the Recognized Institutions and the Heads, University Departments is invited to this office Circular No. AAMS_UGS/ICC/2022-23/93 dated 20th August, 2022 relating to the syllabus of B.Sc. (Artificial Intelligence & Sports Analytics) Sem I & II (CBCS).

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in Sports Science & Management at its meeting held on 16th May, 2025 and subsequently passed by the Board of Deans at its meeting held on 19th May, 2025 vide item No. 8.18 (N) have been accepted by the Academic Council at its meeting held on 20th May, 2025 vide item No.8.39 (N) regarding introduction of syllabus of in B.Sc.(Artificial Intelligence in Sports Analytics) (Sem III, IV, V and VI) (CBCS) is introduced as per appendix with effect from the academic year 2024-25, Progressively.

(The Circular is available on the University's website www.mu.ac.in).

MUMBAI – 400 032

18th June, 2025

To

(Dr. Prasad Karande)
REGISTRAR

All the Principals of the Affiliated Colleges, Directors of the Recognized Institutions and the Heads, University Departments.

A.C./8.39(N)/20/05/2025

Copy forwarded with Compliments for information to:-

- 1) The Chairman, Board of Deans,
- 2) The Dean, Faculty of Interdisciplinary Studies,
- 3) The Chairman, Ad-hoc Board of Studies in Sports Science & Management,
- 4) The Director, Board of Examinations and Evaluation,
- 5) The Director, Board of Students Development,
- 6) The Director, Department of Information & Communication Technology,
- 7) The Director, Centre for Distance and Online Education (CDOE), Vidyanagari.
- 8) The Deputy Registrar, Admissions, Enrolment, Eligibility & Migration Department (AEM),

Copy forwarded for information and necessary action to :-	
1	The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Dept)(AEM), dr@eligi.mu.ac.in
2	The Deputy Registrar, Result unit, Vidyanagari drresults@exam.mu.ac.in
3	The Deputy Registrar, Marks and Certificate Unit,. Vidyanagari dr.verification@mu.ac.in
4	The Deputy Registrar, Appointment Unit, Vidyanagari dr.appointment@exam.mu.ac.in
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6	The Deputy Registrar, College Affiliations & Development Department (CAD), deputyregistrar.uni@gmail.com
7	The Deputy Registrar, PRO, Fort, (Publication Section), Pro@mu.ac.in
8	The Deputy Registrar, Executive Authorities Section (EA) eau120@fort.mu.ac.in He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
9	The Deputy Registrar, Research Administration & Promotion Cell (RAPC), rapc@mu.ac.in
10	The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA) dy.registrar.tau.fort.mu.ac.in ar.tau@fort.mu.ac.in
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17	The Director, Centre for Distance and Online Education (CDOE), Vidyanagari, director@idol.mu.ac.in
18	Director, Innovation, Incubation and Linkages, Dr. Sachin Laddha pinkumanno@gmail.com
19	Director, Department of Lifelong Learning and Extension (DLLE), dlleuniversityofmumbai@gmail.com

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2	P.A to Pro-Vice-Chancellor pvc@fort.mu.ac.in
3	P.A to Registrar, registrar@fort.mu.ac.in
4	P.A to all Deans of all Faculties
5	P.A to Finance & Account Officers, (F & A.O), camu@accounts.mu.ac.in

To,

1	The Chairman, Board of Deans pvc@fort.mu.ac.in
2	Faculty of Humanities, Offg. Dean 1. Prof.Anil Singh Dranilsingh129@gmail.com Offg. Associate Dean 2. Prof.Manisha Karne mkarne@economics.mu.ac.in 3. Dr.Suchitra Naik Naiksuchitra27@gmail.com
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AC - 20/05/2025

Item No. 8.39

UNIVERSITY OF MUMBAI



**Program: BSc (Artificial Intelligence and Sport
Analytics)**

SEM III, IV, V, VI

(Choice Based and Credit System)

From: A.Y. 2024-2025 Progressively

UNIVERSITY OF MUMBAI



Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course	S.Y. B.Sc. (Artificial Intelligence and Sport Analytics) Sem III & IV
2	Eligibility for Admission	As per University regulations
3	Passing Marks	40% (Internal 10/25 Marks and External 30/75)
4	Ordinances / Regulations (if any)	
5	No. of Years / Semesters	Three Years/Six Semesters Programme (Syllabus for Sem III & IV)
6	Level	UG
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic Year	From Academic Year: 2021-22

Sd/-

**Sign of the BOS
Chairman
Dr. Manoj N. Reddy
Ad-hoc Board of
Studies in
Sports Science and
Management**

Sd/-

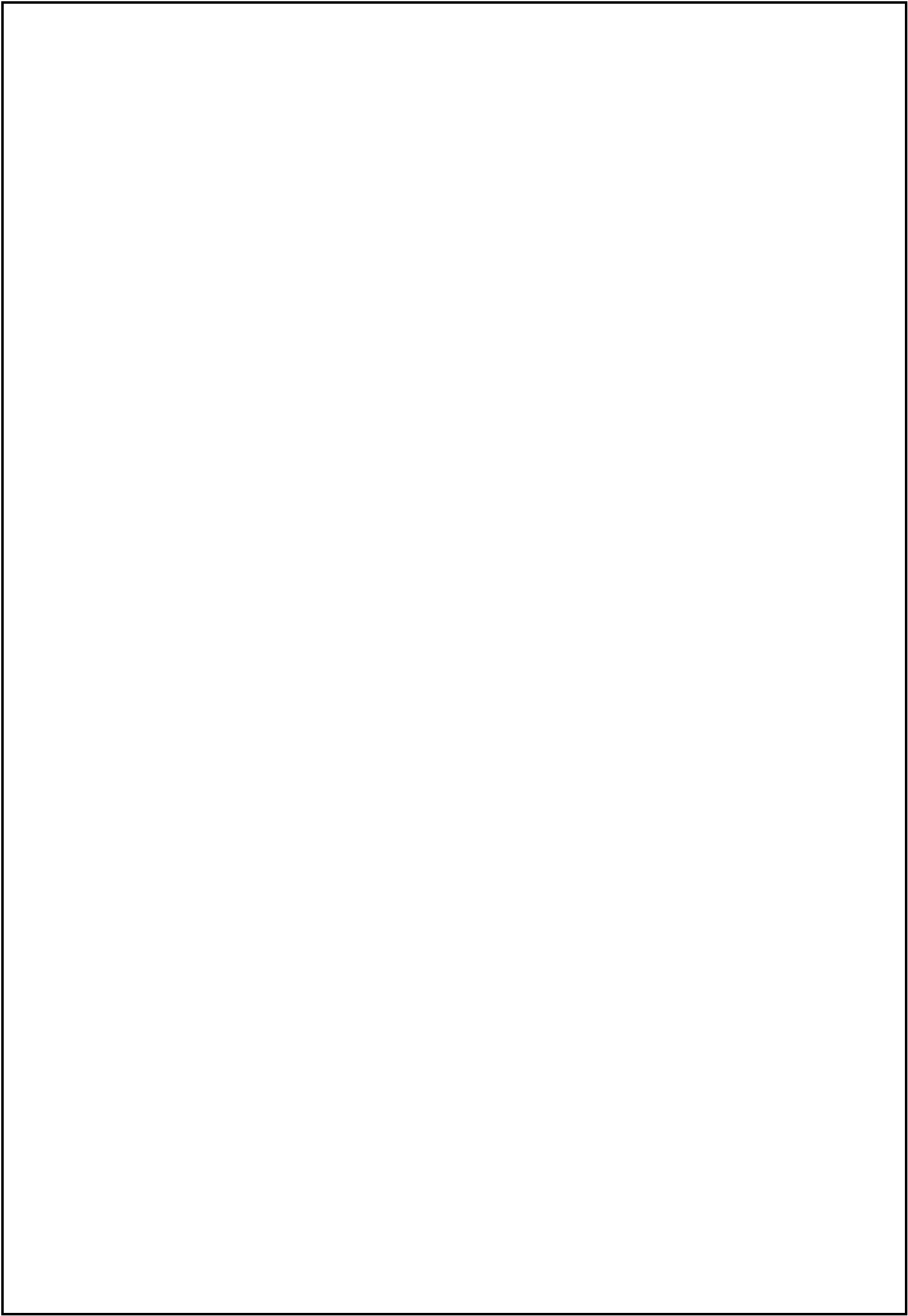
**Sign of the
Offg. Associate
Dean
Dr. C.A.Chakradeo
Faculty of
Interdisciplinary
Studies**

Sd/-

**Sign of the
Offg. Associate Dean
Dr. Kunal Ingle
Faculty of
Interdisciplinary
Studies**

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**Sign of the
Offg. Dean
Prof. A. K. Singh
Faculty of
Interdisciplinary
Studies**



No: 6767

Title of the course - BSc (Artificial Intelligence and Sport Analytics)

O.No. 6768

Eligibility: Passed 10+2 scheme of any recognized State/Central/International Board

Scheme of Examination

The Semester End Examination will be conducted for 60 Marks each subject

Internal Assessments will be conducted for 40 Marks each subject

The allocation of 40 marks shall be on the following basis: -

- a) Periodical class tests/presentations held in the given semester (30 Marks)
- b) Attendance and Active participation in routine class instructional deliveries (05 Marks)
- c) Overall Conduct as a responsible student, mannerism and articulation and Exhibition of leadership qualities in organizing related academic activities. (05 Marks)

Question Paper Pattern for Semester End Examination (60 Marks)

There will be Seven Questions in all.

Q1 would be compulsory and would carry ---- 20 Marks

In addition to Q1, there would be six questions.
Each question would carry 10 Marks. Q7 will have three sub – questions and each sub – question would carry 05 Marks

Students have to attempt any four out of the remaining six Questions and within Q7 students have to attempt any two out of three sub – questions.

In all, students have to attempt five questions i.e. (Q1+Any Four of the remaining)

Q1 = 20 Marks (Compulsory)

Attempt Any Four out of the Remaining Six

Q2 – Q6 = 10 Marks

Q7 Any two from (a) or (b) or (c) ----- (5x2) = 10 Marks

Standard of Passing: A Student has to separately secure minimum 50% marks (i.e. 20 out of 40) in The internal assessments and secure minimum 50% marks (i.e. 30 out of 60) in the Semester End Examination in every subject to be declared as Pass.

Intake Capacity: The maximum intake capacity of B.Sc. (Artificial Intelligence and Sports Analytics) course as per University of Mumbai is 60 per academic year.

**Syllabi for BSc. Artificial Intelligence and Sport Analytics
– SEM III & IV**

BSc. Artificial Intelligence and Sports Analytics
Semester – III

SEMESTER – III	CREDITS
COURSE	
CORE	
Design and Analysis of Algorithm	3
Machine Learning	3
Operating Systems	3
Foundations of AI	3
SCHOOL ELECTIVES 2/3	
Python Programming for Machine Learning	3
Principles of Marketing	3
Internet and Web Programming	3
SPECIAL ELECTIVES 1/3	
Sports Facility and Event Management	3
International Economics	3
Introduction to Philosophy	3

SEMESTER III**Course Code:**
AIC301**Course Title: Design and Analysis of Algorithms****Credits: 3****Lectures/Week:3****Learning Objectives:**

- The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.
- Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.

Course Description: In this Course students learn different algorithm and in this course mention algorithm complexity

Unit I	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space tradeoffs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	Hou rs 6
Unit II	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	7
Unit III	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm	6
Unit IV	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	6
Unit V	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	6

References:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading,MA

Design and Analysis Labs**Duration 13 Hours**

Topics to be covered:

Implement Binary Search using Divide and Conquer approach

- Implement Merge Sort using Divide and Conquer approach
- Implement Quick Sort using Divide and Conquer approach
- Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
- Find the minimum number of scalar multiplication needed for chain of matrix
- Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm)
- Implement Traveling Salesman Problem
- Implement 15 Puzzle Problem
- Implement 8 Queen problem
- Graph Coloring Problem
- Hamiltonian Problem
- Knapsack Problem
- Job sequencing with deadlines

Semester – III**Course Code:****Course Title: Machine Learning****Credits: 3****Lectures
/Week:3****AIC302****Learning Objectives:**

- Understand the fundamental concepts and principles of machine learning, including supervised learning, unsupervised learning, and reinforcement learning.
- Familiarize with various types of machine learning algorithms, such as decision trees, support vector machines, neural networks, and ensemble methods.
- Learn about data preprocessing techniques, including feature selection, feature scaling, and handling missing data.
- Gain knowledge of different evaluation metrics and techniques to assess the performance of machine learning models.

- Explore model selection and hyperparameter tuning techniques for optimizing machine learning algorithms.
- Understand the concepts of overfitting, underfitting, and bias-variance tradeoff in machine learning.
- Learn about different techniques for handling imbalanced datasets and dealing with class imbalance problems.
- Gain practical experience in implementing machine learning algorithms using popular libraries and frameworks such as Scikit-learn and TensorFlow.
- Apply machine learning techniques to real-world datasets and solve various prediction, classification, and clustering tasks.
- Understand the ethical considerations and implications of machine learning, including fairness, transparency, and interpretability.
- Explore advanced topics in machine learning, such as deep learning, natural language processing, and computer vision.

Course Description: This course provides a comprehensive introduction to the theory and practice of machine learning. Machine learning is a field of study that focuses on developing algorithms and models that enable computers to learn from data and make predictions or decisions without being explicitly programmed. This course covers a wide range of machine learning techniques and their applications, equipping students with the skills necessary to understand, implement, and evaluate machine learning models

Unit I	Introduction, Motivation for machine learning, Applications, Machine learning, Classification, Regression, The origin of machine learning, Time line of machine learning techniques, Uses and abuses of machine learning, How do machines learn, Abstraction and knowledge representation, Generalization, Assessing the success of learning, Steps to apply machine learning to data, Input data and ML algorithm, Machine learning methods, Unsupervised learning, Semi-supervised learning, Clustering, What are we looking for? Classification of machine learning algorithms, General ML architecture, Reinforcement learning, Supervised learning, Unsupervised learning, Semi-supervised learning, Regularization algorithms, Clustering algorithms, Deep learning algorithms, Ensemble learning, Matching data to an appropriate algorithm.	7
Unit II	Introduction, Supervised learning, Regression, Regression examples, Regression models, Steps in regression analysis, Linear regression, Simple linear regression, Least squares estimation, Least squares regression-Line of best fit, Illustration, Direct regression method, Maximum likelihood estimation, Matrix approach, Regression assumptions and model properties, Coefficient of determination (R-squared), Example, Testing for significance, Testing hypothesis in simple linear regression, Illustration, Checking model adequacy, Over-fitting, Detecting over-fit models: Cross validation, Cross validation: The ideal procedure, Logistic regression.	7
Unit III	Introduction, Ordinary least squares estimation for multiple linear regression, Multiple linear regression model building, Partial correlation and regression model building, Multiple linear regression model, Interpretation of multiple linear regression coefficients-Partial regression coefficients, Standardized regression coefficients, Missing data, Validation of multiple regression model, Coefficient of multiple determination (RSquared), Adjusted R-squared, Statistical significance of individual variables in multiple linear regression: t-Test.	6

Unit IV	Preamble: Machine learning, To classify faces and expressions, Introduction, ML classifier, Classification and general approach, Classification algorithms, Instance based learning, K-Nearest neighbour, Decision trees, Attribute selection measure: Information gain, ID3 algorithm, Decision tree: weekend example, Converting a tree to rules, Bayesian algorithms, Ensemble, Stories of success, Why ensemble works? Ensemble of classifiers, Bagging, Boosting, Random forests, Neuralnetworks, Activation functions, Feedforward neural network, Multi-layer perceptron, Backprop algorithm, Recurrent or feedback architecture, Perceptron rule, Gradient-descent (training examples, η), Multilayer networks and back propagation algorithm, Support vector machine, Classification model evaluation and selection, ROC curves, Cost Benefit Analysis (CBA).	10
Unit V	Clustering, Clustering algorithms, More common clustering situation, Statistics associated with cluster analysis, General applications of clustering, Clustering as a pre-processing tool, Hard vs. soft clustering, Similarity and dissimilarity between objects, Type of data in clustering analysis, Binary variables, Nominal variables, Ordinal variables, Major clustering approaches, Types of clusters, Cluster centroid and distances, Hierarchical clustering, Hierarchical Agglomerative Clustering (HAC), Hierarchical Agglomerative Clustering: Linkage method, Hierarchical Agglomerative Clustering: Variance and Centroid method, Cluster distance measures, Single link agglomerative clustering, Complete-link clustering, Average-link clustering, Other agglomerative clustering methods, Distance between two clusters, Hierarchical clustering: Time and Space requirements, K - means clustering, Importance of choosing initial centroids, The K-medoids clustering method, PAM (Partitioning Around Medoids), CLARA (Clustering Large Applications), CLARANS (Randomized CLARA), Density based clustering methods, DBSCAN: Density Based Spatial Clustering of Applications with Noise, When DBSCAN Does NOT Work Well, External criteria for clustering quality, Different aspects of cluster validation, Measures of cluster validity, Measuring cluster validity via correlation, Using similarity matrix for cluster validation, Internal measures: SSE, Framework for cluster validity, Internal measures: Cohesion and Separation, Internal measures: Silhouette coefficient.	7
Unit VI	Information retrieval: introduction, Information retrieval process, Information retrieval architecture, how do we represent document? Information retrieval models, Similarity metric, Term weighting, Retrieval in vector space model, Constructing inverted index (word counting), Stop words removal, Stemming, Text document clustering, Agglomerative vs. divisive, Impact of cluster distance measure, Buckshot clustering, Issues related to cosine similarity, Validity of document clusters, Text datasets, Experimental evaluation.	8

References:

1. The Hundred-Page Machine Learning Book by Andriy Burkov.
2. Machine Learning For Absolute Beginners by Oliver Theobald.
3. Programming Collective Intelligence by Toby Segaran.
4. Machine Learning for Humans by Vishal Maini and Samer Sabri.

Lab Exercises –

Exercise 1: Linear Regression

Exercise 2: Best Fit for LR

Exercise 3: Logistic Regression

Exercise 4: Logistic Regression - New Product Purchase Dataset

Exercise 5: Multiple Linear Regression

Exercise 6: Multiple Linear Regression Using Random Data

Exercise 7: KNN Accuracy Prediction

Exercise 8: KNN algorithm implementation on Breast Cancer Data

Exercise 9: KNN algorithm implementation with random value and its power calculation

Exercise 10: Implement a Decision Tree using Balance Scale Dataset

Exercise 11: Implement Naïve Bayes Classification Using iris data

Exercise 12: Implement Support vector machine using random dataset

Exercise 13: Implement Principal component analysis with Wine dataset

Exercise 14: Implement Bagging using Sonar Dataset

Exercise 15: Implement Boosting using Mushroom Dataset and AdaBoost Classifier

Exercise 16: DBSCAN with credit card Dataset

Semester – III			
Course Code:AIC303	Course Title: Operating System	Credits: 3	Lectures/Week:3
Learning Objectives: - To learn the mechanisms of OS to handle processes and threads and their communication - To learn the mechanisms involved in memory management in contemporary OS - To gain knowledge on distributed operating system concepts that includes architecture Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols - To know the components and management aspects of concurrency management.			
Course Description: - This course examines the important problems in operating system design and implementation. - The operating system provides an established, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run.			
Unit I	Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	Hours 4	
Unit II	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	4	
Unit III	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problematic.	4	
Unit IV	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	6	
Unit V	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirtybit –	6	

	Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance(SC), Not recently used (NRU) and Least Recently	
Unit VI	I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent, I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (Linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling -FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	8

References:

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India.

Course Title: Operating System Lab	Duration : 13 Hours
Topics to be Covered:	• Managing Unix/Linux Operating System : Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, Partitions, Swap space, Device files, Raw and Block files, Formatting disks, • Making file systems, Superblock, I- nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and

	methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user. Switching group, Removing users & usergroups. • Process : starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process. • Signal : signal handling, sending signals, signal interface, signal sets. • Semaphore : programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v). • Inter-process communication [6P]: pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC version V).
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Semester – III

Course Code: AIC304	Course Title: Foundation of AI	Credits: 3	Lectures/Week: 3
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Learning Objectives:

- Compare AI with human intelligence and traditional information processing and discuss its strengths and limitations as well as its application to complex and human-centred problems.
- Discuss the core concepts and algorithms of advanced AI, including informed searching, CSP, logic, uncertain knowledge and reasoning, dynamic Bayesian networks, graphical models, decision making, multiagent, inductive learning, statistical learning, reinforcement learning, deep learning, natural language processing, robotics, and so on.
- Apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.
- Analyze the structures and algorithms of a selection of techniques related to searching, reasoning, machine learning, and language processing.

Course Description: The objectives of this course are to provide students with comprehensive and in-depth knowledge of AI principles and techniques by introducing AI's fundamental problems, and the state-of-the-art models and algorithms used to undertake these problems. This course is also designed to expose students to the frontiers of AI-intensive computing and information systems, while providing a sufficiently strong foundation to encourage further research

Unit I	Introduction: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac -Toe problem	Hours 2
Unit II	Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	2
Unit III	Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs	3
Unit IV	Solving problems by searching : problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	5
Unit V	Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems	5
Unit VI	Adversarial search :Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening. Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation. Using predicate logic :Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction	5

Unit VII	Representing knowledge using rules : Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge. Probabilistic Reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	5
Unit VIII	Expert Systems : Representing and using domain knowledge, expert system shells, knowledge acquisition.	5

References:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

Course Title: Foundations of Artificial Intelligence Lab	Duration: 13 Hours
Topics to be covered:	Assignments to be framed Programming Languages such as PROLOG & LISP

Semester – III			
Course Code: AIE3011	Course Title: Python Programming for Machine Learning	Credits: 3	Lectures /Week: 3
Learning Objectives: • To understand the python programming constructs like decision making, control statements • To understand python data structures like tuples, lists, dictionaries • To understand functions and exception handling in python			
Course Description: The objective of this course is to provide the student an insight of python programming including the data structure of python.			
Unit I	Introduction: History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator Conditional Statements If ,If else, Nested if-else, Looping, For, While, Nested loops	Hours 5	
Unit II	Control Statements Break, Continue, Pass String Manipulation Accessing Strings, Basic Operations, String slices, Function and Methods Lists Introduction, Accessing list, Operations, Working with lists, Function and Methods	6	
Unit III	Tuple Introduction, Accessing tuples, Operations, Working, Functions and Methods Dictionaries Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	6	
Unit IV	Functions Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables Modules Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions	8	

Unit V	Exception Handling Exception, Exception Handling, Except clause, Try ? finally clause, User Defined Exceptions	5
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References:

1. "Dive Into Python" by Mark Pilgrim
2. "Programming Python" by Mark Lutz and O'Reilly Media
3. "Python Testing Cookbook" by Greg L Turnquist
4. "Head First Programming" by Paul Barry and David Griffiths

Course Name: Python Programming Lab	No of Labs : 13 (each lab duration 1 hour)
Objectives	● To write, test, and debug simple Python Programs ● To implement Python programs with conditionals and loops ● Use functions for structuring Python programs ● Represent compound data using Python lists, tuples, dictionaries ● Read and write data from/to files in Python.
List of Programs	1. Compute the GCD of two numbers. 2. Find the square root of a number (Newton's method) 3. Exponentiation (power of a number) 4. Find the maximum of a list of numbers 5. Linear search and Binary search 6. Selection sort, Insertion sort 7. Merge sort 8. First n prime numbers 9. Multiply matrices 10. Programs that take command line arguments (word count) 11. Find the most frequent words in a text read from a file 12. Simulate elliptical orbits in Pygame 13. Simulate bouncing ball using Pygame

Semester – III

Course Code: AIE3013	Course Title: Principles of Marketing	Credits: 3	Lectures /Week: 3
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Learning Objectives:

- Define marketing.
- Outline the 4Ps of marketing.
- Explain the difference between the 4 components of marketing in the definition of marketing and the 4P components.
- Define what value means in marketing.
- Identify the differences between market-oriented, product-orientated, and selling-oriented companies.

Course Description:

- In this course, you will **learn about the marketing process and examine the range of marketing decisions an organization must make to sell its products and services.**
- You will also learn how to think like a marketer – and the best marketers know that the focus of marketing has always been on the consumer.

Unit I	Introduction to marketing- Definition, Scope, Functions and Evolution of Marketing. Marketing environment, Macro and micro environment, SWOT analysis, Marketing mix.	Hours 5
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Unit II	Consumer Behaviour- Meaning, Determinants- Cultural, Social, Personal, Psychological Industrial Buying Behaviour- Meaning, characteristics; differences between consumer buying and industrial buying behaviour Marketing research process - Defining research problem, research objective research techniques, sampling, data collection and analysis, report writing Market Segmentation Targeting & Positioning (STP) - meaning, benefits of market segmentation, basis of segmentation; Target Market; Branding- definition, importance, branding strategy; Packaging.	15
Unit III	Concepts of products, Product Mix, Product Line, Product width, depth; Product Life Cycle meaning and stages, New Product Development- steps Pricing- meaning, objectives and methods of pricing Distribution Channel- meaning, Types of Distribution channel- Direct & Indirect. Role of intermediaries and distribution channel management	15
Unit IV	Promotion – elements of promotion mix Sales management- selling process, functions of sales manager Service Marketing- meaning, Service Marketing Mix, Characteristics of Service. Reasons for growth of service sector, Service Quality Model	10
References: • Marketing Management – P Kotler – Prentice Hall • Marketing Management – Stanton, Etzel and Walker – McGraw Hill		

Semester – III			
Course Code: AIE3012	Course Title: Internet and Web Programming	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand best technologies for solving web client/server problems • Analyze and design real time web applications • Use Java script for dynamic effects and to validate form input entry • Analyze to Use appropriate client-side or Server-side applications			
Course Description: On completion of this course, a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and project based experience needed for entry into web application and development careers.			
Unit I	Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail): POP3, SMTP	Hours	5
Unit II	HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps: map, area, attributes of image area. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.		5
Unit III	PERL : Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object- string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.		6
Unit IV	Client-Server programming In Java: Java Socket, Java RMI. Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.		6
Unit V	Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.		5

References:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. 2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Course Title: Internet and Web Programming Lab	Duration : 18 Hours
Topics to be Covered	• Develop web based application using suitable client side and server side web technologies • Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management • Create web pages using HTML, Java Script, CSS - Write Programs using PERL

Semester –III			
Course Code: AIE3021	Course Title: Sports Facility and Event Management	Credits: 3	Lectures/Week: 3
Learning Objectives: • Explain the basic issues related to planning facilities, including site selection, design and construction process • Explain the different forms of public and private funding of sport facilities and ethical issues involved in utilising public funds • Describe the process involved in event planning and management • Explain the event and facility issues pertinent to participants, spectators and sponsors • Describe the operation of venues and events including staffing, box office management, security, concessions and maintenance • Explain the legal issues facing event and facility management including the risk management process • Analyse the process of event bidding and venue selection			
Course Description: This course module will enable a sports manager to understand a core component of planning and operating sports and recreational facilities and events.			
Unit I	Understanding the Sports Industry – Players and Opportunities Sports Infrastructure – the cradle of the sporting ecosystem Overview and Facility Planning Facility Construction and Event Planning	Hours	5
Unit II	Designing, Planning and Controlling Event Logistics Providing Hospitality and Sports Events Sports Sponsorships Bid Assignment Evaluating Events and Managing Staff		5
Unit III	Negotiations and Contracts Risk Management – Protecting your Investment Event Marketing Merchandising, Sales, Ticketing Law, Ethics, Marketing and Finance Quiz Economics of Sports Facilities Officials, Athletes, Match Day – Planning and Process		8

	Alcohol + F&B Management	
Unit IV	Opportunities and challenges towards building an Olympics Event Bidding Assignment Evaluating Events and Managing Staff Field Trip – Fire, Health and Safety Drill, Quality Control Crowd Engagement Facility Design Project – Presentation – Event Objective Financial Plan Supply List Promotion Plan Staffing Plan Registration Plan Evaluation Plan Cancellation plan Critical Dates Event Evaluation SAI Centre – Case Study Odisha Government – Case Study (Adoption of Hockey)	12

Unit V	Practical Presentation - In groups, students to study and present on a Design, Build, Operate and Maintain basis – the following TransStadia sport facilities viz: Football ground, swimming pool, Indoor sports hall & tennis courts. Students will present on the facility design, the sport surface used (natural / synthetic), the costs of building such a surface, pros and cons, the Lighting systems used, maintenance processes, Field visit - Visit to the DY Patil stadium, to understand all facilities Event proposal - Present a Sport event plan proposal for the Hosting of a NON-TELEVISED event within the TS Indoor Arena Event organization - Organise a multi-sport school event / organize a non-mainstream sport FIELD event focused around fitness (American Ninja Warrior / Devils Circuit Obstacle Course Race)	15
References: • Sports turf science, construction and maintenance • Foundations of managing Sporting events • “Contemporary Sport Management” by Paul M. Pedersen, Lucie Thibault, and Paul Pedersen • “Managing Sport Facilities and Major Events” by Hans Westerbeek, Aaron Smith, Paul Turner, and Paul Emery		

Semester – III			
Course Code: AIE3022	Course Title: International Economics	Credits: 3	Lectures/Week: 3
Learning Objectives: • Defines the types of international economic integration by understanding the purpose and significance of international organizations • Explains the international organizations with economic and social objectives in the United Nations and this system • Explains organizations operating in the area of international monetary, trade and development at the global level and evaluates the activities of these organizations. • Explains regional economic integration organizations and compares them. • Explains the aims and activities of regional development banks			
Course Description: • Students are able to critically explore issues and policies in International Economics are equipped to apply theoretical principles of international trade to the prevailing global economic environment. Students are imbued with skill sets to comprehend the critical issues involved in framing and implementation of international trade policies.			
Unit I	Introduction to the global environment – Environment for foreign trade and investment • Effects of globalization on firms • External influences on India's business environment	Hou rs	5
Unit II	International trade theories, Barriers to trade and their impact on the economy. • Costs and benefits of trade • Theory of comparative advantage, H-O Theory • International product cycle • New trade theory • Porter's theory of national competitive advantage • Governmental influence on trade, Tariff		15
Unit III	International institutions and trade blocs Global market entry strategies Foreign investment		10
Unit IV	The foreign exchange market International taxation and transfer pricing Foreign trade in India Direction and composition of India's trade.		15
References: • International Business, Environments and Operations, 12th edition, by John Daniels, Lee Radebaugh (Pearson) • International Business, 6th edition by Charles Hill, Arun Jain (Tata McGraw Hill) • International Finance by Prakash Apte, Mc • International Economics, 2nd edition, by Robert Feenstra, Alan Taylor (Palgrave Macmillan) • International Economics by Paul Krugman, Maurice Obstfeld, 8th edition (Pearson)			

Semester –III			
Course Code: AIE3023	Course Title: Introduction to Philosophy	Credits: 3	Lectures/Week: 3
Learning Objectives: • Analyze key events (including historical, social, economic, and/or personal) that influenced a particular form of creative human expression. • Analyze key events (including historical, social, economic, and/or personal) that demonstrate how a particular form of creative human expression influenced other works. • Evaluate a particular form of creative human expression in the context of the appropriate academic discipline. • D. Create or reconstruct an expression of the human experience and share with others (if the class is performance based).			
Course Description: • This course provides an introduction to the types of philosophy and the study of the great thinkers' contributions to studies which investigate the principles and facts of reality, human nature and basic problems of conduct relevant to man. Emphasis is on early Greek philosophy: Plato and Aristotle. This course will include writing assignments.			
Unit I	Introduction: RHETORIC vs LOGIC • Truth & Rhetoric • Plato's theory of the forms • Logic: Pre & Post scientific revolution • Identifying arguments: Deductive vs. Inductive Readings • Bertrand Russell (1949): Philosophy for laymen • Armstrong: "What is Philosophy?" • George Hole "How to read Philosophy"		Hou rs 5
Unit II	Formal Argument • Core questions in Philosophy • Does God exist? • Meaning & morality of God's existence: Humanism via being God like Readings • Dennett (2005): "Atheism & Evolution" • Pascals' wager: Blaise Pascal. "The Wage" from Pensées		10

Unit III	Epistemology • What is epistemology • Descartes & the scientific revolution • Arguments Readings • Descartes in Cottingham, pp 21-25 • Locke in Cottingham, pp 25-31	10
Unit IV	Metaphysics • Mind body problem • Dualism • Functionalism • Metaphysics of identity Readings • Theseus' ship • Descartes Meditation IV & VI • What does Mary Learn? (Exercise) • Frank Jackson, (1982:130) Raymond Smullyan, "An unfortunate dualist"	10
Unit V	Applications • Ethics & Decision making • Free will Case studies Michael J. Sandel, "The Case Against Perfection", The Atlantic, April 2004 https://www.theatlantic.com/magazine/archive/2004/04/the-case-against-perfection/302927/ Alastair Norcross, "Puppies, Pigs & People", RiceUniversity, 2004 (PDF) https://spot.colorado.edu/~heathwoo/readings/norcross.pdf	10
References: • Western Philosophy: An Anthology, 3rd edition, John Cottingham, Wiley-Blackwell. • On Bullshit, Harry G. Frankfurt, Princeton University Press • The Philosophy Book: Big Ideas Simply Explained, Will Buckingham, DK • Modern Philosophy: An Introduction and Survey, Roger Scruton, Penguin Books		

Evaluation Scheme

Continuous Assessment (C.A.) -

C.A. – I: Test – Rubric to assess

C.A. – II:

Organization and Development of Ideas	Analysis and Evaluation

Semester End Examination (SEE) -

Passing marks shall be 40% for all subjects compulsorily

**Curated by TransStadia Institute - Centre of Excellence, Mumbai*

BSc. Data Science and Sports Studies
Semester – IV

SEMESTER – IV	CREDITS
COURSE	
CORE	
Deep Learning	3
Organizational Behaviour	4
Marketing Management	3
Minor Project	3
SCHOOL ELECTIVES 2/3	
Data Mining and Warehousing	3
Introduction to Data Analytics	3
Financial Management	3
SPECIAL ELECTIVES 1/3	
Doping Control in Sport	3
Talent Management in Sport	3
Financial Services	3

Semester –IV			
Course Code: AIC401	Course Title: Deep Learning	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand the fundamental concepts and principles of deep learning, including neural networks, activation functions, and backpropagation. • Familiarize with various deep learning architectures, such as feedforward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and generative adversarial networks (GANs). • Learn about different types of layers and their functionalities in deep learning models, including fully connected layers, convolutional layers, and recurrent layers. • Gain knowledge of different activation functions and their impact on the performance of deep learning models. • Explore optimization algorithms and techniques for training deep neural networks, including stochastic gradient descent (SGD), Adam optimizer, and learning rate schedules. • Understand techniques for regularization and handling overfitting in deep learning, such as dropout, batch normalization, and early stopping. • Learn about transfer learning and pre-trained models for leveraging existing deep learning architectures and weights. • Gain practical experience in implementing deep learning models using popular deep learning libraries and frameworks such as TensorFlow and PyTorch. • Apply deep learning techniques to real-world problems in computer vision, natural language processing, and other relevant domains. • Explore advanced topics in deep learning, such as deep reinforcement learning, attention mechanisms, and generative models. • Understand the ethical considerations and implications of deep learning, including bias, fairness, and interpretability.			
Course Description: This course provides a comprehensive introduction to the field of deep learning, which focuses on developing and training neural networks with multiple layers to solve complex problems. Deep learning has revolutionized various domains, including computer vision, natural language processing, and speech recognition. This course covers the fundamental concepts, architectures, and techniques of deep learning, enabling students to understand, implement, and apply deep learning models effectively.			
Unit I	How is deep learning different from other machine learning, AI vs ML vs DL, Deep learning capabilities, Other approaches to artificial intelligence, what is special about deep learning? Relevance of deep learning.	Hours 4	
Unit II	Supervised learning, Unsupervised learning, Memory based learning, Memory based learning techniques, Hebbian learning, Hebbian learning modifications: Mathematical models, Competitive learning, Error correction learning, Boltzmann learning, Learning tasks: Pattern association, Learning tasks: Pattern recognition and function approximation, Learning tasks: Control and filtering, Learning tasks: Beamforming, Memory, Adaptations, Statistical nature of the learning process, Statistical learning theory, Probably approximately correct model of learning, Adaptive filtering problems, Unconstrained optimization techniques, Linear least-squares filters, Least-mean-square algorithms, Learning curves, Learning rate annealing techniques,	6	

	Perceptron, Perceptron convergence theorem, MLP concepts, Backpropagation algorithm, XOR problem, Heuristics for making backpropagation algorithm perform better, Output representation and decision rules, Feature detection, Backpropagation and differentiation, Hessian matrix, Generalization, Approximations of functions, Crossvalidations, Network pruning techniques, Virtues and limitations of backpropagation learning, Accelerated convergence of backpropagation learning, Supervised learning viewed as optimization problem, Cover's theorem on the separability of patterns, Interpolation problem, Regularization theory and regularization networks, Generalized radialbasis function networks, Estimation of the regularization parameter, Approximation properties of RBF networks, Comparison of RBF networks and multilayer perceptron, Kernel regression and its relation to RBF networks, Learning strategies in RBF networks, Simulated annealing, Boltzmann machines, Deterministic Boltzmann machine.	
Unit III	How does a neural network look like? The matrix magic, Visualizing deep learning, The elephant in the room, Programmatic expression of deep learning's math constructs, Operations with the tensors, Array broadcasting, Scalar product/Inner product of tensors, Morphing shapes of tensors, Gradient calculation	5
Unit IV	Deep learning depths, Model: The molecules of DL, Loss functions in neural networks, Optimizers in neural networks, Activation functions, Finding the perfect fit, Running deep learning algorithms: The frameworks, Real examples and actual schematics of building neural nets, Data preparation and label preparation, Examples of neural networks at work, Ready data for neural nets, Constructing the network, ReLU, Constructing the network, Approach validation, Plotting the loss from validation & training, What experiments do we run next? An example in regression: Guess the price of the house, Processing the data, Building the network, K-fold approach for validating algorithm, K-fold approach: In code.	5
Unit V	Convolutional neural networks, What and how of ConvNets, Example 1, Example 2, Convolution effectiveness, what is this convolution and why is it effective? Visualization of 2D convolution, Visualization of 3D convolution, Building a model without any max-pooling layers, How to train a CNN on a dataset from ground-up, Importance of deep learning when data is limited, Downloading Datasets, Working on it, Building a CNN, one layer at a time, Data preprocessing: Preparing the data, Accuracy & loss: Data processing, Making the most of what's available: Data Augmentation, Accuracy & loss: Data augmentation, Using a trained CNN, How about extracting features without augmenting data? Accuracy & loss: Without data augmentation, how about extracting features with augmenting data? Accuracy & loss: With augmenting data, Tuning the CNN, what do Convolutional Neural Network (CNN, or ConvNet) see? Seeing the intermediate, Points to ponder, Visualizing the filters themselves, looking at heat maps of how filters seek details.	5
Unit VI	Recurrent Neural Network (RNN), Why recurrent networks? RNN explained, Deep RNNs, Recursive neural networks, Step function, Tanh function, RNN in memory, LSTMs and GRUs, Long Short Term Memory (LSTM), Working components of LSTMs, Core idea behind LSTMs, LSTM: A	7

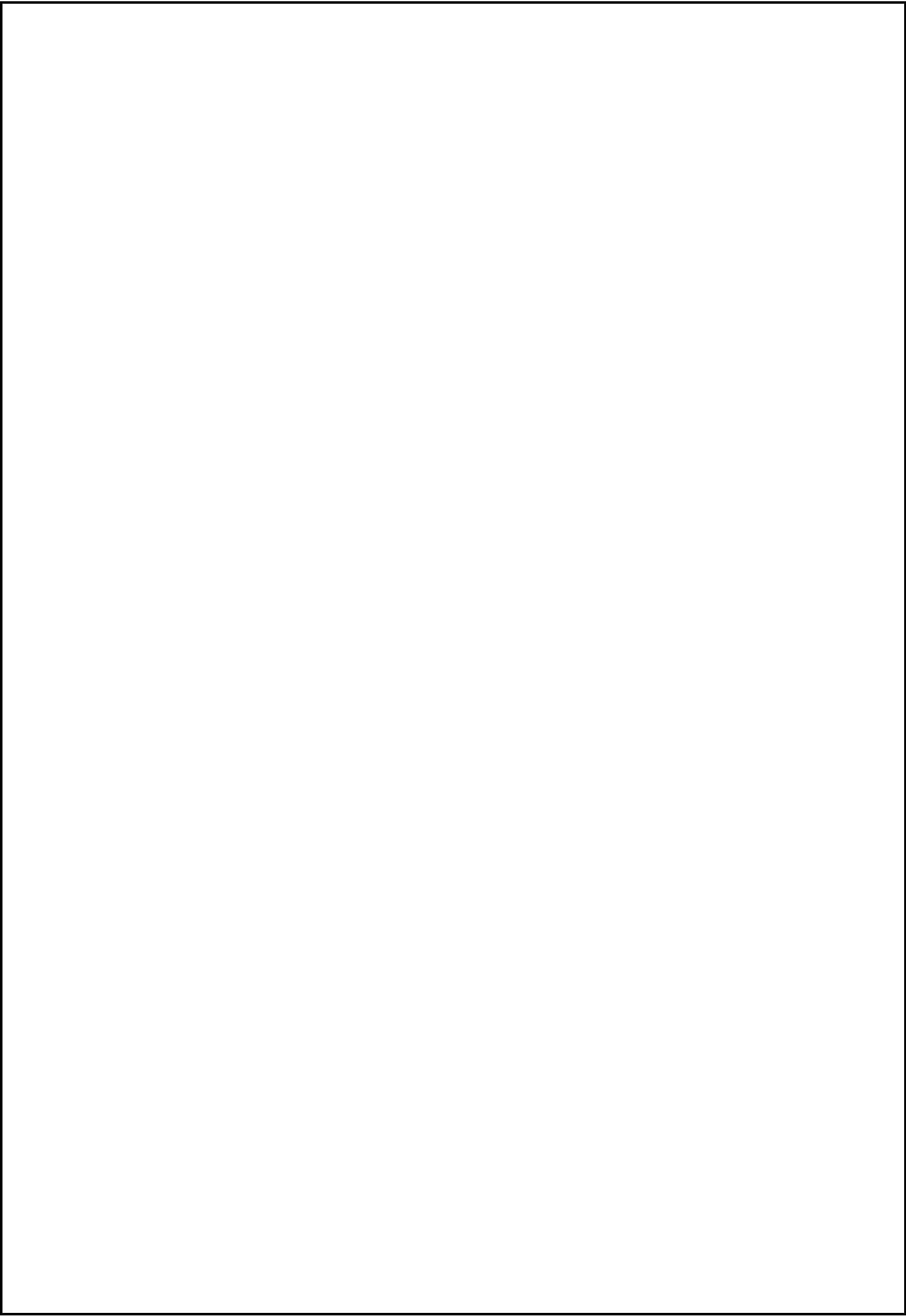
	simple walk through, Gated Recurrent Unit (GRU), GRU design steps, Fully gated vs minimal gated architecture of GRU, Working of RNN's, Recurrent neural networks, Backpropagation through timeline in RNN, Backpropagation through Computational graphs, Problem Statement 1, Problem Statement 2, Complex recurrent neural networks, Over-fitting and under-fitting, Detect and avoid overfitting, Prevent of overfitting an approach on model and data, Multi-layered RNNs, Stacked LSTM, Stacked LSTM architecture, Multi-directional RNNs, Difference between LSTM and BI-LSTM, One-dimensional sequence processing, CNN and RNN.	
Unit VII	Generative deep learning, Using LSTMs to synthesize text, Text synthetization procedures, Neural style transfer and applications, NST working principle, Content and style management in NST, NST implementation, Image synthesis with variational auto encoders, Need for image synthesis, Working models, Variational Auto Encoders (VAE), Latent space, Generative Adversarial Networks (GAN's), Generative and discriminative algorithms, Applications using GAN, GAN working principle, Generator and discriminator, Training GAN, Implementing GAN: 1st generation.	4
Unit VIII	MIMO deep learning models, Concept in MIMO, Auto-Encoder with SISO modelling, Supervised learning in wireless communications, Un-Supervised learning in wireless communications, Reinforcement learning in wireless communications, Q learning in wireless communications, Multi armed bandits in D2D networks in wireless communications, Layers graphs: Acyclic and directional, Directed acyclic graphs, Introducing cyclic graphs in neural networks, Creating matrices from graphs, Multi-scale CNN, Can layers share weights?, Hyperparameter tuning, Process and features, Hyperparameter categories, Hyperparameter specification approaches, Hyperparameter tuning process, Algorithms, Hyperparameter working and optimization, Hyperparameter value flow, Ensemble modeling: Bag of tricks, Ensemble techniques: Simple level, Ensemble techniques: Advanced level, Bagging vs boosting, Advantages and disadvantages of ensemble, Algorithms using bagging and boosting.	5
Unit IX	Information-theoretic machine learning, Basic concepts of information theory, Information processing in analog channels, Some common terminologies, Deep neural networks: Information theoretical perspective, Information bottleneck methodology, Concepts to remember, Capacity modelling theorems, Characteristics of deep neural network layers, Phases in double optimization, Encoder and decoder in DNN, Learning theory, Stochastic relation and hidden layers, Applying information gain, Hebbian learning, Implementation of Hebbian learning in a perceptron, Limitations of Hebbian learning, Competitive learning, What is competition in neural networks? Characteristics of competitive learning, Criteria for competitive learning, Architecture and implementation, Mathematical representation, Competitive learning, Competitive learning rule, Hebbian learning and competitive learning, Boltzmann learning, Boltzmann machines, Energy-Based Models (EBMs), Restricted Boltzmann machines, Restricted Boltzmann machines working, Radial-basis function networks, RBF network architecture, RBF neuron activation function, RBFN as a neural network, Advantages of using RBNN than the MLP.	4

References:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
2. "Deep Learning with Python" by François Chollet.
3. "Deep Learning for Computer Vision" by Adrian Rosebrock.
4. "Deep Reinforcement Learning" by Pieter Abbeel and John Schulman.
5. "Generative Deep Learning" by David Foster.
6. "Deep Learning with PyTorch" by Eli Stevens, Luca Antiga, and Thomas Viehmann

Lab Exercises –

- Exercise 1: Print Dimensions of dataset
- Exercise 2: Calculation of accuracy values
- Exercise 3: Compose Matrix Shape and Tensor Shape
- Exercise 4: LMS Implementation
- Exercise 5: Back-Propagation Implementation
- Exercise 6: Accessing and manipulation of tensors
- Exercise 7: Training a binary classifier
- Exercise 8: Access and manipulation of tensors
- Exercise 9: Regression Data Sampling
- Exercise 10: Combatting Overfitting Problem in NN
- Exercise 11: Training a CNN
- Exercise 12: Model Reusability
- Exercise 13: Model accuracy comparison and cleaning
- Exercise 14: Stages of the convnet
- Exercise 15: Sequence Classification Problem
- Exercise 16: Text-to-Speech synthesis
- Exercise 17: Text Generation
- Exercise 18: Automatic Image Captioning
- Exercise 19: Automatic Image Captioning with Keras
- Exercise 20: Facial Recognition
- Exercise 21: Digit Recognition
- Exercise 22: Hand Movement Recognition
- Exercise 23: Implementing a Recurrent Neural Network
- Exercise 24: RNN generating "Flower" names



Semester – IV

Course Code: AIC402	Course Title: Organizational Behavior	Credits: 3	Lectures/Week:3
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Learning Objectives:

- Organizational behavior studies how and why individual employees and groups of employees behave the way they do within an organizational setting. The three main reasons for studying organizational behavior in your organization are to be able to explain it, predict it, and influence it.

Course Description:

- This course aims to lay the foundation of understanding of human behavior in organizations through an exposure to organizational behavior theories, case studies and live examples. This course has a large applied component to it in order to facilitate hands-on learning of contemporary organizational challenges.

Unit I	Introduction to Organizational behavior – nature and Structure Contemporary Approaches to organizational behavior Social learning frame work Individual differences – personality, diversity	Hours 5
Unit II	Perception Attitudes and satisfaction Job stress Group dynamics Informal organization structure Informal communication Information processing	10
Unit III	Conflict resolution Negotiations Decision making and control Control process and its elements Organizational culture Change management	15
Unit IV	Cases, Simulation games, blogs and audio visual material, psychometric tests	15

References:

- Mullins, L. J. (2007). *Management and organisational behaviour*. Pearson education.
- Business Organization and Management by Bhushan Y.K.
- Business Organization by Gupta C.B
- Organizational Behaviour by L.M. Prasad
- Wood, J. M., Zeffane, R. M., Fromholtz, M., Wiesner, R., Morrison, R., Factor, A. Osborn, R. N. (2016). *Organisational behaviour: Core concepts and applications*. John Wiley & Sons Australia, Ltd.

Semester – IV

Course Code: AIC403	Course Title: Marketing Management	Credits: 3	Lectures/Week:3
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Learning Objectives:

- To develop conceptual clarity of marketing management area at a fairly advanced level.
- To create marketing consciousness among students.
- To explain the macroeconomic relevance of marketing in a developing country like India.
- To develop skills in case study analysis.

Course Description:

This course includes analyzing markets, strategy of development of Market, Social Responsibility, Branding, Price, Promotion and distributions.

Unit I	Analyzing markets and identifying opportunities Introduction and company analysis Competitive analysis Customer analysis	Hours 10
Unit II	Marketing strategy development Segmentation, Targeting and Positioning Social Responsibility and marketing Branding Innovation in marketing strategy	15
Unit III	Formulating marketing programs Marketing products for multi-sided demand markets Price and Promotion Distribution	15
Unit IV	Class Project, Case study evaluation	5

References:

- Kotler, Philip, and Kevin Keller. Marketing Management. 13th ed. Prentice Hall, 2008
- Best, Roger J. Market-Based Management – Strategies for Growing Customer Value and Profitability. 5th ed. Prentice Hall, 2009.

Semester – IV			
Course Code: AIC404	Course Title: Minor Project	Credits: 3	Lectures/Week:3
Learning Objective: Students able to learn real world problem.			
Course Description: • To enable students to apply the knowledge and skills acquired during the B.Sc AI and Sports Analytics program in the implementation of a data science project. • To provide students with hands-on experience in implementing data science methodologies and techniques to solve real-world problems.			
Unit I	Minor projects in consultation with departmental Project supervisor. A Synopsis and a complete project report has to be submitted post completion of the project	Hours 5 Months	

Semester – IV			
Course Code: AIE4011	Course Title: Data Mining And Warehousing	Credits: 3	Lectures/Week:3
Learning Objectives: • Be familiar with mathematical foundations of data mining tools. • Understand and implement classical models and algorithms in data warehouses and data mining • Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.			
Course Description: This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.			
Unit I	Overview of Data warehousing Strategic information and the need for Data warehousing, Defining a Data warehouse, Evolution of Data warehousing, Data warehousing and Business Intelligence	Hours 3	
Unit II	The Building Blocks of Data warehouse Defining features - Subjectoriented data, Integrated data, Time-variant data, Nonvolatile data, Data granularity Data warehouses and Data marts Architectural Types - Centralized, Independent data marts, Federated, Hub-and-Spoke, Data mart bus Overview of components - Source Data, Data Staging, Data Storage, Information Delivery, Metadata, and Management and Control components	3	

Unit III	Business Requirements and Data warehouse Dimensional nature of Business data and Dimensional Analysis, Dimension hierarchies and categories, Key Business Metrics (Facts), Requirement Gathering methods and Requirements Definition Document (contents) Business Requirements and Data Design - Structure for Business Dimensions and Key Measurements, Levels of detail Business Requirements and the Architecture plan Business Requirements and Data Storage Specifications Business Requirements and Information Delivery Strategy	3
Unit IV	Data warehouse Architecture and Infrastructure Architectural components Concepts of Data warehouse architecture - Definition and architecture in the areas of Data acquisition, Data storage, and Information delivery Distinguishing characteristics - Different objectives and scope, Data content, Complex analysis for faster response, Flexible and Dynamic, Metadata-driven etc Architectural Framework - supporting flow of data, and the Management and Control module Technical architecture - Data acquisition, Data storage, and Information delivery Overview of the components of Architectural	3
Unit V	Infrastructure for Data warehousing Distinction between architecture and infrastructure, Understanding of how data warehouse infrastructure supports its architecture Components of physical infrastructure, Hardware and Operating systems for data warehouse, Database Software, Collection of Tools, Data warehouse Appliances - evolution and benefits	3
Unit VI	The role of Metadata Understanding the importance of Metadata Metadata types by functional areas - Data acquisition, Data storage, and Information delivery Business Metadata - overview of content and examples Technical Metadata - overview of content and examples Metadata Requirements, Sources of Metadata, Metadata management - challenges, Metadata Repository, Metadata integration and standards	3
Unit VII	Principles of Dimensional Modeling Data Design - Design decisions, Basics of Dimensional modeling, E-R modeling versus Dimensional modeling The STAR schema - illustration, Dimension Table, Fact Table, Factless Fact Table, Data granularity STAR schema keys - Primary, Surrogate, and Foreign Advantages of the STAR schema, STAR schema Examples	3
Unit VIII	Data Quality Importance of data quality, Challenges for data quality, Data quality tools, Data cleansing and purification, Master Data Management. Matching information to classes of users Information from Data warehouse versus Operational systems, Users of information - their needs and how to provide information Information delivery - queries, reports, analysis, and applications Information delivery tools - Desktop environment, Methodology and criteria for tool selection, Information delivery framework, Business Activity Monitoring, Dashboards and Scorecards	4

Unit IX	OLAP in Data warehouse Overall concept of Online Analytical Processing (OLAP), OLAP definitions and rules, OLAP characteristics Major features and functions of OLAP - General features, Dimensional analysis, Hypercubes, Drill Down and Roll Up, Slice and Dice, Rotation, Uses and Benefits Familiarity with OLAP models - Overview of variations, MOLAP, ROLAP, HOLAP, DOLAP, Database OLAP, Web OLAP Data Mining Overview of Data mining - Definition, Knowledge Discovery Process (Relationships, Patterns, Phases of the process), OLAP versus Data mining Some aspects of Data mining - Association rules, Outlier analysis, Predictive analytics etc) Concepts of Data mining in a Data warehouse environment Major Data Mining techniques - Cluster Detection, Decision Trees, Memory-based Reasoning, Link Analysis, Neural Networks, Genetic Algorithms etc Data Mining Applications in industry - Benefits of Data mining, Discussion on applications in Customer Relationship Management (CRM), Retail, Telecommunication, Biotechnology, Banking and Finance etc	5
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References:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India
2. Data Warehousing, Data Mining, & OLAP - Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India

Semester – IV			
Course Code: AIE4012	Course Title: Introduction to Data analytics	Credits: 3	Lectures/Week:3
Learning Objectives: • To understand the concept of data analytics • To understand the data modelling including data definitions and analysis techniques • To learn basic descriptive statistics			
Course Description: This course will help the students to understand the basic and advanced concepts of data analysis using mathematical modelling.			

Unit I	Introduction to Data modeling: Conceptual, Logical and physical modeling, Top down and Bottom Up modeling, ER Modeling with different methodologies, Generic data modeling, Semantic data modeling, Data modeling with different techniques (finite state machine, UML, state charts, Markov Chain, Decision table and decision tree), Data Dictionary	Hours 9
Unit II	Data Definitions and Analysis Techniques • Elements, Variables, and Data categorization • Levels of Measurement • Data management and indexing	9
Unit III	Descriptive Statistics • Measures of central tendency • Measures of location of dispersions	9
Unit IV	Basic Analysis Techniques • Basic analysis techniques • Statistical hypothesis generation and testing • Chi-Square test • t-Test • Analysis of variance • Correlation analysis • Maximum likelihood test	10
Unit V	Data analysis techniques • Regression analysis • Classification techniques • Clustering • Association rules analysis	8

References:

1. Data modeling essentials – Graeme Simsion
2. The Data model resource book- Len Silverston
3. Data Sciences & Analytics, V.K. Jain (Khanna)

Semester –IV			
Course Code: AIE4013	Course Title: Financial Management	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand basic concepts of financial management and their application in investment, financing and dividend decisions. • Understand concepts of cost of capital, leverage analysis, capital structure and dividend theories and identify courses of action in financial environment that would result in maximization of wealth of an organization. • Understand management of working capital and estimate the same for an organization.			
Course Description: This course is designed to survey the field of finance and provide the foundation for more advanced finance coursework. Topics include sources of business and financial information, financial statement, analysis, risk and return, asset valuation, capital budgeting, capital structure, business financial planning and working capital management.			
Unit I	Introduction of Business Finance Financial Manager’s role Financial Goal and Firms Objectives Limitations of various type of sources of fund	Hours 15	
Unit II	Capital structure and Leverage Meaning of Financial Leverage, Measures of financial Leverage, Financial leverage and shareholders Return Combining financial and Operating leverage Venture capital financing Development of Venture capital in India Future Prospects of Venture Financing.	15	
Unit III	Cost of Capital The cost of capital and opportunity cost concept Determining component, cost of capital Capital and Investment Analysis	15	
References: 1. Handbook of Finance, Investment Management and Financial Management 2. Smart Financial Management: The Essential Reference for the Successful Small Business Richard Crawford, 2004			

Semester – IV			
Course Code: AIE4021	Course Title: Doping Control in Sport	Credits: 3	Lectures/Week: 3
Learning Objectives: After completing the course - You will have knowledge about the role and responsibility of medical support personnel related to the administration of drugs to athletes and to the role of pharmacists in the prevention of doping - You will have knowledge about the anti-doping rules (World Anti-Doping Code, International standards, national rules) and national and international anti-doping work - You will have knowledge about WADAs prohibited list, therapeutic use exemption and the Norwegian drug search database, and how to use this knowledge to advice athletes in correct use of drugs - You will have knowledge about common diagnoses amongst athletes and treatment of these, included pain management, anti-inflammatory drugs, asthma treatment, hormonal treatment and the use of stimulating drugs including drugs of abuse - You will have knowledge about doping analysis, including procedures, methods and result management, and dosing of drugs considering the prohibited list and doping analysis - You will have knowledge about the use of dietary supplements, and the use of this knowledge to do risk assessments, and prevention of doping both in sport and the society.			
Course Description: - The course offers an introduction to the use of medicines for athletes and its relation to the anti-doping rules. It will focus on the role of pharmacists to avoid doping violations, as a result of either intended or inadvertent doping. - This course is designed to provide basic understanding of Anti-Doping and to equip them and those working in the anti-doping field to advise and support athletes to make the best choices regarding anti-doping while ensuring compliance with the rules of the World Anti-Doping Code (WADC), sports federations, and national anti-doping agencies. It will also empower them to become educators and supporters to athletes and other athlete support personnel on anti-doping and clean sport matters, including the safe and informed selection of medications and supplements. - This course outline the roles and responsibilities and to strengthen their understanding on doping in sports, this course covers the testing procedures, education, Anti-Doping Rule Violations (ADRV) and many more.			
Unit I	What is doping? Why do athletes give in to doping? Organizations and doping: prevention and repression Bio analytical and forensic approaches to doping	Hours	

Unit II	WADA – Information/ Education Guidelines to Prevent Doping in Sport Psychological Support for Athletes Sports Genetics and Performance Exercise Immunology	
Unit III	Athlete Handbook – Information Pocket Guide Coaches Guide Health Advantages and Disadvantages to athletes Testing Guidelines National Anti- Doping Policy Athlete – Rights and Responsibilities Guide Non – Analytical Investigations Principles Whereabouts Policy Whistleblowing Policy World Anti- Doping Code Testing and Investigations International Standards Protection of Privacy and Personal Information International Standard Laboratories – International Standard Results Management – International Standard Prohibited List – International Standard Therapeutic Exemptions – International Standards Therapeutic Exemptions Policy – International Standards	
Unit IV	Substance Abuse Treatment, Prevention and Policy. Legal, Regulatory and Prevention Practice Provisions	
Unit V	Movie Review – Icarus Tour de France Sharapova Case Narsingh Yadav Case NADA Review WADA Review UNESCO's Convention Against Doping	

Unit VI	Practicals Individual assignment - Students will select a sport and explore the motivation for doping in each of these. They will also present the kind of drugs that will largely be “beneficial” to them in this particular sport. Through this, students will learn about why and how athletes are pushed towards doping (ignorance in substance intake, injury recovery, performance enhancement, weight loss etc) Movie Review - Icarus Case Studies - In groups, students to present the case studies of famous athletes who have been found guilty of doping. Students will present the background, the accusation, the journey through the charges being investigated, the reasons why the athlete indulged in doping, the sanctions Skit - one group will engage in Doping, the counter group will have to question and demonstrate the process by which they have been suspected, and the process followed to complete the investigation Guest lecture - WADA / NADA and the processes in place to avoid / detect doping	18
References: • Doping In Elite Sports: Voices of French Sportspeople and Their Doctors Christophe Brissonneau, Jeffery • Doping In Non-Olympic Sports: Challenging the legitimacy Lovely Dasgupta • Fair play in sport: A moral Norm System Sigmund Toland • Doping & Anti-doping Policy in Sport Mike McNamee, Verner Moller		

Semester –IV			
Course Code: AIE4022	Course Title: Talent Management in Sport	Credits: 3	Lectures/Week: 2
Learning Objectives: • Define what talent management is and why it is critical. • Identify the planning stages of talent management • Searching and recognizing talent • Summarize the processes for hiring talent • Develop and improve talent • Processes behind Performance Management, Talent Retention and succession planning. • Mastery of Lesson content at Levels of 70% of higher.			
Course Description: • This course dives deep into the strategic process of identifying, developing, and retaining talented athletes and personnel within the sports industry. • Students will explore the entire talent management lifecycle, from scouting and recruitment to performance optimization and career planning. • The course will analyze successful strategies used by professional teams, academies, and governing bodies to maximize their human capital and achieve a competitive advantage.			
Unit I	History of Talent Management and different approaches Definition of Talent in Business, Talent Management System Talent Management Practices Developing A systemic, Strategic Approach to Talent Management	Hours	
Unit II	Managing Talent Commercial Management Player Management Talent Representation Types Talent Management Practices to Focus on Digital Talent Management		
Unit III	Organisational Gain Performance Management Diversity and Inclusion in leading Talent Strategic Talent Analytics Aligning Legal Aspects		
Unit IV	Movie Review: Moneyball Coach Carter Michael Jordan – Documentary Netflix Breaking Point – LeeHesh LinkedIn Learning – What is Talent Management Strategy (2017, June 2). <i>What is a talent management strategy?</i> [Video 3:53]. YouTube. The Predictive Index. (2019, August 9). <i>Talent strategy is changing consulting.</i> [Video 6:48]. YouTube Sen, S. (2019). <i>Talent management.</i> Society Publishing Quirk, E. (2018, May 14). <i>The top 5 benefits of having a talent management system.</i> LinkedIn Learning. (2017, June 2). What is a talent management strategy? [Video]. YouTube.		

	Whitesell, L. (2019, September 27). Why talent management is an important business strategy. <i>Sponsored Insights</i>. Quirk, E. (2018, May 14). <i>The top 5 benefits of having a talent management system</i>. <i>Issues of secrecy versus transparency</i>	
Unit V	Practicals Movie Review - Movie: Moneyball / Jerry Maguire / Million Dollar Arm / Ballers/ Ford vs Ferrari Individual assignment: Report writing - Students to present a written assignment on “Managing an athlete the early years – from the personal side to the professional side” Presentation - Each group to select a sport and present how they would “acquire” a client from a particular club to represent, how they would manage his professional commitments – contracts, endorsements, image rights etc,; structuring of his/her athlete representation contract; how they would prevent their player from leaving their agency and joining another	12
References: 1. “Talent Identification and Development in Sport: International Perspectives” edited by Joseph Baker, Stephen Copley, and Jörg Schorer 2. “The Talent Lab: The Secret to Finding, Creating and Sustaining Success” by Owen Slot		

Semester-IV**Course Code:**
AIE4023**Course Title: Financial Services****Credits: 3****Lectures/Week: 3**

Learning Objectives: Learn about the services offered by such companies • Analyze the ways these companies earn profits. • Introduces students to the main concepts behind investing • Discriminates among different ways to invest money. • Examine contemporary issues including the level of personal saving in the United States, ethics in the financial services industry, and the industry's effect on communities and families.

Course Description: This course gives students an overview of banks and other financial services companies. Financial Services provides students with an overview of banks and other financial services companies. The course begins by introducing students to the origins of money and banking, and then examines the early history of banking in the United States. Students move into an in-depth study of the financial services industry and explore the types of companies that make up this industry.

Unit I

Introduction to financial services
Difference between product and services
marketing Characteristics and Classification of services
Paradigms in services marketing
Role of Services in Economy

Hours

10

Unit II

Services marketing mix
Augmented marketing mix
Developing the service product
Services product planning, pricing strategy and promotions
Role of communication in service marketing
People and internal communication
Process of operations and delivery of services
Role of technology in services marketing.

10

Unit III	Personal Selling & Marketing Strategy: Sales Management Personal Selling and salesmanship Organizing the Sales Effort Sales Organization Distribution of financial services	10
Unit IV	Sales Force Management in financial services Recruiting and Selecting Sales Personnel Planning Executing and Evaluating Sales Training Programme Motivating and Compensating Sales Personnel Controlling the Sales Effort Sales control and cost analysis	10
Unit V	Live sales project, case analysis, group projects	5

References:

- Baron S and Harris K- *Services Marketing: Text and Cases* (Palgrave, 2003)
- Lovelock- *Services Marketing: People, Technology and Strategy* (Pearson Education, 5th edition).
- Zeithaml, V. A and Bitner, M. J. - *Services Marketing* (Tata McGraw-Hill).
- S. L. Gupta *Marketing of Services* (Sultan Chand).

Evaluation Scheme

Continuous Assessment (C.A.) -

C.A. – I: Test – Rubric to assess

C.A. – II:

Organization and Development of Ideas	Analysis and Evaluation

Semester End Examination (SEE) -

Passing marks shall be 40% for all subjects compulsorily.

**Curated by TransStadia Institute - Centre of Excellence, Mumbai*

BSc Artificial Intelligence & Sports Analytics						
First Year						
Particulars	Fee Category					
	J and K Students (need to be confirm)	NRI Student	Out side Maharashtra (equal to open)	within Maharashtra (Open Category)	within Maharashtra (Reserved)	University Fees for Students without Eligibility
ID Card	25	25	25	25	25	25
Admission Form / Application Form Fees	50	50	50	50	50	50
Group Insurance	20	20	20	20	20	20
Ashvamedha	20	20	20	20	20	20
Admission processing fees	60	60	60	60	60	60
Dip Registration	15	15	15	15	15	15
Other Fee	125	125	125	125	125	125
Gymkhana Fees	190	190	190	190	190	190
Students welfare	500	500	500	500	500	500
Vice Chancellor's Fund	20	20	20	20	20	20
Eligibility Fees	500	500	500	500	500	500
Disaster Relief Fund	10	10	10	10	10	10
Development Fee	1,173	1,173	1,173	1,173	1,173	1,173
Exam Fee	700	700	700	700	700	700
Caution Money Deposit	-	-	-	-	-	-
Tuition Fee	1,41,592	7,00,000	1,41,592	1,41,592	-	1,41,592
Library Fee	1,000	1,000	1,000	1,000	1,000	1,000
Site Visit	5,000	10,000	5,000	5,000	5,000	5,000
IT Lab	20,000	10,000	20,000	20,000	20,000	20,000
Seminars (Industry Experts)	15,000	15,000	15,000	15,000	15,000	15,000
Sports Equipment	5,000	10,000	5,000	5,000	5,000	5,000
Kit Fee	1,000	1,000	1,000	1,000	1,000	1,000
Students' Activity	3,000	3,000	3,000	3,000	3,000	3,000
Total Amount	1,95,000	7,53,408	1,95,000	1,95,000	53,408	1,95,000

BSc BSc Artificial Intelligence & Sports Analytics						
Second Year						
Particulars	Fee Category					
	J and K Students (need to be confirm)	NRI Student	Out side Maharashtra (equal to open)	within Maharashtra (Open Category)	within Maharashtra (Reserved)	University Fees for Students without Eligibility
ID Card	25	25	25	25	25	25
Admission Form / Application Form Fees	50	50	50	50	50	50
Group Insurance	20	20	20	20	20	20
Ashvamedha	20	20	20	20	20	20
Admission processing fees	60	60	60	60	60	60
Dip Registration	15	15	15	15	15	15
Other Fee	125	125	125	125	125	125
Gymkhana Fees	190	190	190	190	190	190
Students welfare	500	500	500	500	500	500
Vice Chancellor's Fund	20	20	20	20	20	20
Eligibility Fees	500	500	500	500	500	500
Disaster Relief Fund	10	10	10	10	10	10
Development Fee	1,173	1,173	1,173	1,173	1,173	1,173
Exam Fee	700	700	700	700	700	700
Caution Money Deposit	-	-	-	-	-	-
Tuition Fee	1,41,592	7,00,000	1,41,592	1,41,592	-	1,41,592
Library Fee	1,000	1,000	1,000	1,000	1,000	1,000
Site Visit	5,000	10,000	5,000	5,000	5,000	5,000
IT Lab	20,000	10,000	20,000	20,000	20,000	20,000
Seminars (Industry Experts)	15,000	15,000	15,000	15,000	15,000	15,000
Sports Equipment	5,000	10,000	5,000	5,000	5,000	5,000
Kit Fee	1,000	1,000	1,000	1,000	1,000	1,000
Students' Activity	3,000	3,000	3,000	3,000	3,000	3,000
Total Amount	1,95,000	7,53,408	1,95,000	1,95,000	53,408	1,95,000

BSc Artificial Intelligence & Sports Analytics						
Third Year						
Particulars	Fee Category					
	J and K Students (need to be confirm)	NRI Student	Out side Maharashtra (equal to open)	within Maharashtra (Open Category)	within Maharashtra (Reserved)	University Fees for Students without Eligibility
ID Card	25	25	25	25	25	25
Admission Form / Application Form Fees	50	50	50	50	50	50
Group Insurance	20	20	20	20	20	20
Ashvamedha	20	20	20	20	20	20
Admission processing fees	60	60	60	60	60	60
Dip Registration	15	15	15	15	15	15
Other Fee	125	125	125	125	125	125
Gymkhana Fees	190	190	190	190	190	190
Students welfare	500	500	500	500	500	500
Vice Chancellor's Fund	20	20	20	20	20	20
Eligibility Fees	500	500	500	500	500	500
Disaster Relief Fund	10	10	10	10	10	10
Development Fee	1,173	1,173	1,173	1,173	1,173	1,173
Exam Fee	700	700	700	700	700	700
Caution Money Deposit	-	-	-	-	-	-
Tuition Fee	1,41,592	7,00,000	1,41,592	1,41,592	-	1,41,592
Library Fee	1,000	1,000	1,000	1,000	1,000	1,000
Site Visit	5,000	10,000	5,000	5,000	5,000	5,000
IT Lab	20,000	10,000	20,000	20,000	20,000	20,000
Seminars (Industry Experts)	15,000	15,000	15,000	15,000	15,000	15,000
Sports Equipment	5,000	10,000	5,000	5,000	5,000	5,000
Kit Fee	1,000	1,000	1,000	1,000	1,000	1,000
Students' Activity	3,000	3,000	3,000	3,000	3,000	3,000
Total Amount	1,95,000	7,53,408	1,95,000	1,95,000	53,408	1,95,000

Mr. Manoj Reddy
Director

Dr. A.K Singh
Dean, Interdisciplinary

AC – 20/05/2025

Item No. _8.39

UNIVERSITY OF MUMBAI



Syllabus for the
Program: T. Y. B.Sc. Sem V & VI (CBCS)
Course: Artificial Intelligence and Sports
Analytics

(Choice Based and Credit System)

(Introduced with effect from the academic year 2025-26)

AC-20/05/2025

Item No. 8.39

UNIVERSITY OF MUMBAI



Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course	T. Y. B.Sc. (Artificial Intelligence and Sports Analytics) Sem V & VI
2	Eligibility for Admission	As per University regulations
3	Passing Marks	40% (Internal 10/25 and External 30/75)
4	Ordinances / Regulations (if any)	
5	No. of Years / Semesters	Three Years Program/Six Semesters Programme (Syllabus for Sem V and VI)
6	Level	UG
7	Pattern	Semester
8	Status	Revised
9	To be implemented from Academic Year	From Academic Year: 2025-26

Mr. Manoj Reddy
Chairman of BOS

Dr. A.K Singh
Dean, Interdisciplinary

No: 6767

Title of the course - BSc (Artificial Intelligence and Sports Analytics)

O.No. 6768

Eligibility: Passed 10+2 scheme of any recognized State/Central/International Board

Scheme of Examination

The Semester End Examination will be conducted for 60 Marks each subject

Internal Assessments will be conducted for 40 Marks each subject

The allocation of 40 marks shall be on the following basis: -

- d) Periodical class tests/presentations held in the given semester (30 Marks)
- e) Attendance and Active participation in routine class instructional deliveries (05 Marks)
- f) Overall Conduct as a responsible student, mannerism and articulation and Exhibition of leadership qualities in organizing related academic activities. (05 Marks)

Question Paper Pattern for Semester End Examination (60 Marks)

There will be Seven Questions in all.

Q1 would be compulsory and would carry -----20 Marks

In addition to Q1, there would be six questions.

Each question would carry 10 Marks. Q7 will have three sub – questions and each sub – question would carry 05 Marks

Students have to attempt any four out of the remaining six Questions and within Q7; students have to attempt any two out of three sub – questions.

In all, students have to attempt five questions i.e. (Q1+Any Four of the remaining)

Q1 = 20 Marks (Compulsory)

Attempt Any Four out of the

remaining Six

Q2 – Q6 = 10 Marks

Q7 Any two from (a) or (b) or (c) ----- (5x2) = 10 Marks

Standard of Passing: A Student has to separately secure minimum 50% marks (i.e. 20 out of 40) in The internal assessments and secure minimum 50% marks (i.e. 30 out of 60) in the Semester End Examination in every subject to be declared as Pass.

Intake Capacity: The maximum intake capacity of B.Sc. (Artificial Intelligence and Sports Analytics) course as per University of Mumbai is 60 per academic year.

**Syllabi for BSc. Artificial Intelligence and Sports
Analytics- SEM V & VI**

BSc. Artificial Intelligence and Sports Analytics
Semester – V

SEMESTER – V	CREDITS
COURSE	
CORE	
Pattern Recognition and Anomaly Detection	3
Business Research Methodology	3
Computational Linguistics and NLP 1	3
Major Project-1	3
SCHOOL ELECTIVES 2/3	
Computer Networks	3
E-Commerce	3
Introduction to Robotics	3
SPECIAL ELECTIVES 1/3	
Fan Engagement	3
Consumer Psychology	3
Corporate Finance	3

Semester –V			
Course Code: AIC502	Course Title: Business Research Methodology	Credits: 3	Lectures/Week:3
Learning Objectives: • Learn about types of Research • Learn to formulate a research problem, and applications in different domains • Learn about various methods of data collection • Learn to represent and analyse the data			
Course Description: The course includes various research methodologies, collection and analyzing of data, different scaling techniques and data analysis tools such as SPSS/Excel			
Unit I	Introduction to Research Methodology Importance, objectives, types of research and steps for research	Hours	5
Unit II	Formulation of the research problem, Defining research problem, literature review, sources of problem for research, developing the research proposal into a research design, use of Statistics Research application in accounting, finance and marketing areas	7	
Unit III	Data Collection Primary data collection methods (questionnaire method, online surveys, observation method), sources of secondary data, survey, questionnaire preparation (characteristics a good questionnaire, layout, pre-test, revision, final), organization of fieldwork, training interviewers, respondents’ attitude, evaluation of field work	8	
Unit IV	Scaling Techniques, Introduction to scales of measurements (nominal, ordinal, interval, Likert) Sample Survey: population, sample, sampling techniques (probability sampling, nonprobability sampling, simple random sampling, stratified random sampling, cluster sampling, systematic sampling), random number table, sample size determination.	8	
Unit V	Summarization and Analysis of Data: tabulation, validation, errors in data, use of computer, univariate and bivariate data analysis, measures of association for categorical data, correlation, regression, hypothesis testing (parametric), biometric tables Interpretation and Report Writing: meaning, steps, LATEX (official software for paper writing)	8	
Unit VI	Introduction to SPSS/Excel	9	
References: Kothari, C. R.: Research Methodology, Methods and Techniques; New Age International Publishers			

Semester –V			
Course Code: AIC501	Course Title: Pattern Recognition and Anomaly Detection	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand the concepts and principles of pattern recognition and anomaly detection. • Explore different types of pattern recognition techniques, such as statistical methods, machine learning algorithms, and neural networks. • Learn about feature extraction and selection methods for representing patterns in data. • Familiarize with classification and clustering algorithms commonly used in pattern recognition and anomaly detection tasks. • Gain knowledge of evaluation metrics and techniques to assess the performance of pattern recognition and anomaly detection models. • Understand the challenges and considerations in applying pattern recognition and anomaly detection in real-world scenarios. • Learn about various applications of pattern recognition and anomaly detection, including fraud detection, image and speech recognition, network intrusion detection, and medical diagnosis. • Gain hands-on experience in implementing pattern recognition and anomaly detection techniques using relevant software tools and libraries. • Explore advanced topics in pattern recognition and anomaly detection, such as deep learning approaches and ensemble methods. • Understand the ethical considerations and privacy implications in pattern recognition and anomaly detection. • Learn how to interpret and communicate the results of pattern recognition and anomaly detection analyses effectively. • Learn about natural language processing (NLP) and computer vision techniques in AI.			
Course Description: This course focuses on the theory, algorithms, and applications of pattern recognition and anomaly detection. Pattern recognition involves identifying and classifying patterns in data, while anomaly detection focuses on identifying abnormal or unusual instances in datasets. These techniques find applications in various domains, including fraud detection, cybersecurity, quality control, and medical diagnostics. This course explores the fundamental concepts, methods, and tools used in pattern recognition and anomaly detection, providing students with the knowledge and skills to effectively analyze and interpret complex datasets.			
Unit I	What is pattern? What is pattern recognition? Pattern recognition techniques, Training and learning in pattern recognition, Pattern recognition applications, Pattern recognition use cases, what is anomaly detection? What are some other practical uses for anomaly detection? How is anomaly detection calculated over time? Key point for AI and ML anomaly detection, Tasks for artificial intelligence, AI system learning process, Test to geometric requirements for curves algebraic, Curves matched to data points, Case study: Anomaly detection with IBM Watson, Probability theory, Maximum likelihood theory and estimation, Model selection, Matrices of uncertainty (confusion matrices), Loss of logging (log-loss), Rate for F1 (F1 score), Metric selection, Hyperparameter selection, The problem with high dimensionality, Information theory.	Hours 7	

Unit II	Understanding statistics, T-test, Z-test, Z-test and t-test difference, Pvalue, Descriptive statistics, Type I error, Type II error, Differences between type I and type II errors, Null hypothesis, Statistical significance, Hypothesis testing, Four steps of hypothesis testing, Real-world example of hypothesis testing, Bonferroni test, Check of one-tailed, Probability distributions, Types of distributions, Regression models, Types of regression, How to select the best model for regression? Common questions, Linear models for classification, Example of positive linear regression.	10
Unit III	Neural networks, how neural networks learn? Neural networks examples, Neural networks use cases, Kernel methods, Sparse kernel machines use cases, Graphical models, Mixture models and EM, Bayesian networks: Directed graphical models, Conditional probability distributions, Potential functions, Conditional independences, Sampling methods for pattern recognition, Continuous latent variables, Combining models for pattern recognition, Markov chain Monte Carlo, The K-means algorithm, Applications of K-means	9
Unit IV	What are anomalies? Applications of anomaly detection, Related use cases, Types of input data, Types of anomalies, Evaluation of an anomaly detector, Taxonomy of approaches, Classification based, Classification use cases, Supervised classification techniques, Nearest neighbour based techniques, Others model techniques, Information theory, Contextual anomaly based, Collective anomaly detection, On-line based model, Distributed anomaly detection, IDS analysis strategy.	10
Unit V	Network intrusion detection, Understanding of IDS core operation, How an IDS works? Types of intrusion detection systems, Fundamental concerns of intrusion detection systems, Intrusion detection vs. intrusion prevention, The future of IDS, Anomaly detection in big data, Key attributes of advanced anomaly detection, The real-world impact of anomaly detection, Anomaly detection on 5G: Possibilities and opportunities, Real time anomaly detection in docker, Hadoop cluster, Anomaly detection in IoT, Detection of deviations in deep learning time series results, Anomaly detection use cases, Anomaly detection with time series forecasting, What is time series analysis? Time series data models, how to find anomaly in time series data? Anomaly detection using machine learning, Anomaly detection using deep learning, Anomaly detection for an e-commerce pricing system, IBM's Watson AIOps automates IT anomaly detection and remediation.	9

References:

1. Pattern Recognition and Machine Learning" by Christopher M. Bishop.
2. Anomaly Detection: Principles and Algorithms" by Chandola, Varun, Arindam Banerjee, and Vipin Kumar.
3. Pattern Classification" by Richard O. Duda, Peter E. Hart, and David G. Stork.
4. Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy.
5. Introduction to Statistical Pattern Recognition" by Keinosuke Fukunaga.
6. Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei.
7. Pattern Recognition: Statistical, Structural and Neural Approaches" by Robert J. Schalkoff.

Exercises-

Exercise 1: Polynomial Curve Fitting

Exercise 2: Probability and Distribution

Exercise 3: Simple Linear regression

Exercise 4: Multiple Linear regression

Exercise 5: Logistic regression Model

Exercise 6: Polynomial regression for classification

Exercise 7: Neural Networks

Exercise 8: Sparse Kernel Machines

Exercise 9: Sampling Methods for Pattern Recognition

Exercise 10: Decision Tree

Exercise 11: Random Forest

Exercise 12: SVM – Support vector Machine

Exercise 13: Local Outlier Factor (LOF)

Exercise 14: Cluster based Local Outlier Factor (CBLOF)

Exercise 15: Local Density Cluster based Outlier Factor (LDCOF)

Exercise 16: Local Correlation Integral (LOCI)

Exercise 17: Influenced Outlierness (INFLO)

Exercise 18. Local Outlier Probability (LoOP)

Exercise 19: Connectivity based Outlier Factor (COF)

Exercise 20: OpenCV - Object Detection with CAM

Exercise 21: OpenCV - Object Detection with Video

Exercise 22: OpenCV - Color Filtering

Exercise 23: OpenCV - Object Detection with Haar cascade

Exercise 24: Graph Theory

Exercise 25: GUI for pattern detection

Semester –V**Course Code:**
AIC503**Course Title: Computational
Linguistics and NLP 1****Credits: 3****Lectures/Week:3****Learning Objectives:**

- Develop a foundational understanding of Natural Language Processing and its significance in language analysis.
- Explore linguistic levels such as morphology, syntax, semantics, and pragmatics to comprehend language structure.
- Gain insights into traditional text processing methods, statistical techniques, and text classification.

Course Description: This course introduces Science undergraduate learners to the fundamental concepts and practical applications of Natural Language Processing (NLP).

Unit I	• Introduction to Natural Language Processing (NLP) and its importance in understanding human language. • Overview of linguistic levels: Morphology (word structure), Syntax (sentence structure), Semantics (meaning), Pragmatics (context usage).	Hours 9
Unit II	• Traditional text processing methods and tools, including statistical methods and text classification. • Scope and significance of text analysis and processing in various domains. • Evaluation methods for text classification and extraction processes	9
Unit III	• Creating text corpora and the role of annotations in NLP tasks. • Basic understanding of statistical techniques and their relevance in NLP. • Hidden Markov Models for Part-of-Speech (POS) tagging and word sense disambiguation.	9
Unit IV	• Introduction to speech recognition and machine translation technologies. • Challenges and limitations in statistical machine translation	9
Unit V	• Exploring statistical parsing techniques and their application in understanding sentence structure. • Word similarity and text similarity methods for measuring semantic relationships	9

References

1. "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper
2. "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" by Daniel Jurafsky and James H. Martin
3. "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and Hinrich Schütze

Semester –V			
Course Code: AIC504	Course Title: Major Project-1	Credits: 3	Lectures/Week:3
	Learning Objective: The object of Major Project -1 is to enable the student to take up investigative study in the broad field of Computer Science and Engineering , either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor.		Hours 45
	Course Description: This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include: Major Project -1 & Dissertation The object of Major Project -1 & Dissertation is to enable the student to extend further the investigative ,study either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.		

Semester –V			
Course Code: AIE5011	Course Title: Computer Networks	Credits: 3	Lectures/Week:3
Learning Objectives: - Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies. - Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols. - Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure. - Have a working knowledge of datagram and internet socket programming			
Course Description: The Computer Networks course is designed to provide students with a comprehensive understanding of the principles, technologies, and protocols that govern the operation of modern computer networks. The course explores the fundamental concepts and components involved in building and maintaining network infrastructure, as well as the methods for achieving reliable and efficient communication between networked devices			
Unit I	Introduction to Computer Networks and Internet: Understanding of network, networks topologies, OSI/TCP/IP Layering, protocols, Network services: connection oriented and connectionless, Switching Techniques, Physical Layer: Different types of transmission media, types of address	Hours 7	
Unit II	Organization, Planning & Decision Making: Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches. Data Link Layer: Error detection (Parity, CRC), Sliding Window, Stop and Wait protocols. LAN: Design, specifications of popular technologies, interconnection of LANs; repeaters, bridges, routers. MAC Layer: Aloha, CSMA, CSMA/CD, CSMA/CA protocols. Examples: Ethernet, including Gigabit Ethernet and WiFi (802.11).	10	
Unit III	Network Layer & Transport Layer: Introduction, Virtual and Datagram networks, Internet Protocol, IPv6, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing Introduction and transport layer services, Multiplexing and Demultiplexing, Connectionless transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control, retransmission, Socket programming with TCP and UDP.	14	
Unit IV	Application & Network Programming: Principles of computer applications, Web, Protocols: HTTP, FTP, E-mail, DNS, SMTP, Socket Programming. Examples: DNS, SMTP, IMAP, HTTP, etc.	11	

Unit V	Concepts of symmetric and asymmetric key cryptography. Sharing of symmetric keys -Diffie Hellman. Public Key Infrastructure. Public Key Authentication Protocols. Symmetric Key Authentication Protocols. Pretty Good Privacy (PGP), IPSec, Firewalls.	06
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References

- Computer Networking- A Top-Down approach, 5th edition, Kurose and Ross, Pearson.
- Computer Networks- A Top-Down approach, Behrouz Forouzan, McGraw Hill.
- Computer Networks, Andrew Tanenbaum, Prentice Hall.
- Computer Networking and the Internet Fred Halsall, Addison Wesley.
- Data Communications and Networking, Behrouz Forouzan, McGrawHill.
- TCP/IP Protocol Suite, Behrouz Forouzan, McGraw Hill.

Semester - V

Course Code: AIE5012	Course Title: E Commerce	Credits: 3	Lectures/Week:3
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Learning Objectives:

- Students Learn different E-commerce rules and cyber laws.
- Students learn different business e-commerce models.

Course Description: To provide an analytical framework to understand the emerging world of e-commerce. Learn Different Business models and Technologies.

Unit I	Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.	Hours 3
Unit II	Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility& Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce .	7
Unit III	Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B,B2C, C2B, C2C, E – Governance.	5
Unit IV	E – strategy : Overview, Strategic Methods for developing E – commerce. Four C's : (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergenceand its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer PremisesEquipment (CPE).	9
Unit V	Supply Chain Management : E – logistics, Supply ChainPortal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power.	7
Unit VI	E – Payment Mechanism : Payment through card system, E – cheque, Cash, E – Payment Threats & Protections	7

References:

1. Vivek Sood Cyber Laws Simplified-TMH (2001)
2. Vakul Sharma Handbook of cyber Laws-Macmillan (2002)
3. Sundeep Oberol e Security and you-TMH (2001)

Semester –V			
Course Code: AIE5013	Course Title: Introduction to Robotics	Credits: 3	Lectures/Week:3
Learning Objectives: • To introduce the functional elements of Robotics • To impart knowledge on the direct and inverse kinematics • To introduce the manipulator differential motion and control • To educate on various path planning techniques • To introduce the dynamics and control of manipulators			
Course Description: In this course, students able to learn different technology of robot. Mathematical representation related robotics.			
Unit I	Brief history-Types of Robot–Technology-Robot classificationsand specifications-Design and control issues- Various manipulators – Sensors– work cell – Programming languages.	Hours 15	
Unit II	Mathematical representation of Robots – Position and orientation – Homogeneous transformation-Variou joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability – Solution methods-Closed form solution.	15	
Unit III	Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints Inverse -Wrist and arm singularity – Static analysis – Force and moment Balance.	15	
References 2. R.K.Mittal and I.J.Nagrath, Robotics and Control,Tata McGraw Hill,New Delhi,4th Reprint, 2005. 3. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009. 4. M.P.Groover, M.Weiss,R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.			

Semester –V**CourseCode:**
AIE5021**Course Title:** Fan Engagement**Credits: 3****Lectures/
Week: 3****Learning Objectives:**

- Students able to learn fan engagement.
- Students able to learn different benefits of fan engagement.

Course Description:

This course will explain the main concepts and best practices of fan engagement, using current methodologies and dealing with examples of real sports institutions.

The environment of the fans and their relationship with sports entities is extremely dynamic and volatile, the creation of new engagement strategies or the implementation of constant innovations rather than just opportunities is nowadays a must.

To provide the participant with knowledge in the management of the relationship between fans and sports institutions.

This course aims to bring participants closer to the main concepts that are part of fan engagement such as fan identification, fan retention, fan experience, new opportunities for sponsorship or brand image, along with several techniques and best practices to encourage fan engagement both in match day and in non – match day.

- To understand the principles of fan engagement.
- To understand the flow of interests in fan engagement and the consequences in the sport business.
- To know the different benefits of fan engagement.
- To understand the difference and importance between match day & non – match day practices.

Unit I

- Introduction to Fan Engagement. Why fan engagement, principles and rationale, Key Concepts of Fan Engagement. Delivering fan engagement
- Understanding the Fan. What is a fan, understanding the nature of fandom
- Fan Engagement Strategy
- Best practices of Fan Engagement. Leadership: creating and sustaining a culture of engagement
- Actual & Future Trends of Fan Engagement.

10

Unit II

- Sports Marketing
- Entertainment Marketing
- Cross Country & Cross Industry Innovation in Sports and Entertainment Marketing

10

Unit III	Technology to create fan engagement Seroquel: Reliability Alertness Attention Certainty TeamQual LEGO Experience Wheel Yoshida Science Article Surveys Censydiam Fan Engagement Scorecard	10
Unit IV	Fan Engagement in Football Factors involved in fan engagement Value of fan engagement Difference in women's events	5
Unit V	Assess the baseline capacity of the event/ organization Identify a desired behaviour change Know your audience Understand barriers and benefits Build a behaviour change campaign Message development and delivery Capture results – measurement + reportingThe final buzzer Case studies	10

References:

1. AI for sports Chris brady, karl tulys, shayegan omid shafei Routledge
2. Winning with Data in the business of sports Fiona Green Routledge
3. The Use of Applied Technology in Team Sport Jose Pino- Ortega, Markel Rico-González Routledge
4. Performance Analysis In Team Sports Pedro Passos, Duarte Araujo, Amma Volossovitch Routledge
5. Computer Science in Sport: Arnold Baca Routledge

Semester –V			
Course Code : AIE5022	Course Title: Consumer Psychology	Credits: 3	Lectures /Week:3
Learning Objectives: • Understand the different frameworks applied to human behavior • Importance of consumer analysis in developing successful marketing strategies • Exposure to relevant theories from across the behavioral sciences • Apply findings to evaluating marketing strategies			
Course Description: Consumer focus has become an important factor in contemporary business approaches. This makes it even more important for marketing since it is a highly customer-driven function. This course focuses on understanding human behavior – how do they choose, use or evaluate goods and services. The theories in this course are derived to understand human behavior through behavioral sciences.			
Unit I	Introduction to Consumer Psychology Motivation and needsof the consumer	Hours 3	
Unit II	Perception Attention Information Categorization	8	
Unit III	Learning and memory Interpersonal influence in marketing and advertising	10	
Unit IV	Decision making Consumer decision making Consumption and satisfaction Culture and sub culture Evaluating marketing strategies and promotions	15	
Unit V	Presentations, case studies, live projects	9	
References: 1. Hoyer, Wayne D., Deborah J. MacInnis, Rick Pieters (2012), Consumer Behavior, 6th Ed. Houghton Mifflin Co: Boston: MA. 2. Cialdini, Robert (2006), Influence: The Psychology of Persuasion, Collins Underhill,Paco (2001) 3. Why We Buy: The Science of Shopping, Texere Publishing			

Semester –V			
Course Code : AIE5023	Course Title: Corporate Finance	Credits: 3	Lectures /Week:3
Learning Objectives: Acquire, interpret, and analyze accounting, economic, and financial data to facilitate decision making in corporate and investment environments in both personal and professional settings.			
Course Description: This course is designed to critically evaluate corporate finance techniques. It enables the student to be able to take an informed decision in a risky business environment.			
Unit I	Overview of Financial Management Meaning, Objectives, Scope, Role and Functions of Financial Management (Financial Decisions) Financial Goal - Profit Maximization versus Shareholders' Wealth Maximization. Time value of Money: (theory and numerical) Concepts, Compounding, Discounting, Annuities Sources of Long-Term Finance Introduction to Equity Shares, Preference Shares and Debentures, Term loan		Hours 10
Unit II	Understanding Dividend Decision Dividend and dividend policy Factors affecting dividend pay-out Dividend payment models: (theory and numerical)		10
Unit III	Cost of Capital: (theory and numerical) Significance, Concept of the Opportunity Cost of Capital Component Costs of Capital - Cost of Debt, Preference Capital and Equity Capital Weighted Average Cost of Capital (WACC) Leverage: (theory and numerical) Types of Leverage - Operating, Financial and Combined Leverage Point of indifference		10

Unit IV	Working Capital Management Concepts of Working Capital Operating Cycle Determinants of Working Capital Estimating Working Capital Needs. (theory and numerical) Working Capital Finance Policies	10
Unit V	Live case studies, presentations, practical assignments	5

References:

1. Prasanna Chandra Financial Management, theory and Practice McGraw - Hill Latest Edition
2. I M Pandey Financial Management Vikas Latest Edition
3. M. Y. Khan and P. K. Jain Financial Management McGraw - Hill Latest Edition

Sem. – VI

BSc. Artificial Intelligence and Sports Analytics
Semester – VI

SEMESTER – VI	
COURSE	CREDITS
CORE	
Computational Linguistics and NLP 2	3
Applications of Machine Learning in Industries	3
Psychology for Wellness	3
Major Project-2	3
SCHOOL ELECTIVES 2/3	
Big Data Analytics	3
Wireless Sensor Networks	3
Computer Vision and Image Processing	3
SPECIAL ELECTIVES 1/3	
Sports Tourism	3
Sports Entrepreneurship	3
Digital Media and Marketing	3

Semester –VI			
Course Code: AIC601	Course Title: Computational Linguistics and NLP 2	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand parsing techniques for analyzing sentence structures and word relationships. • Learn about information retrieval using NLP and its applications in question answering and information extraction. • Explore emerging applications of NLP, including multimedia presentations, education, and healthcare. • Develop practical skills to evaluate and apply NLP techniques for text analysis and processing.			
Course Description: Students will explore linguistic levels, traditional text processing methods, statistical techniques, parsing, information retrieval, and various NLP applications. The course aims to equip students with essential skills to analyze and process text data, understand language structures, and apply NLP techniques in real-world contexts.			
Unit I	Applications of NLP in various domains: Information extraction, report generation, and ontology construction. Introduction to multimedia presentation generation: Integrating multimedia elements with NLP.	Hours 10	
Unit II	Scripted dialogue and language interfaces in intelligent tutoring systems. Introduction to argumentation techniques for healthcare information dissemination. Basics of sentiment analysis and its role in understanding opinions. Defocus, Construction of 3D model from images	10	
Unit III	Exploration of emerging NLP applications: Multimedia presentations, education, and healthcare. NLP models in healthcare and their contributions to medical data analysis	5	
Unit -IV	Document-level and sentence-level sentiment analysis: Understanding and categorizing sentiment in text. Introduction to opinion summarization: Condensing opinions and reviews for efficient analysis., Medial representations, Multiresolution analysis	5	
Reference Books: 1. "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze 2 "Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data" by Dipanjan Sarkar 3. "Natural Language Processing for Computational Linguistics and Artificial Intelligence" by Roberto Garigliano			

SEMESTER – VI

Course Code: AIC602	Course Title: Application of Machine Learning in Industries	Credits: 3	Lectures/Week:3
Learning Objectives: • Understand the principles and fundamentals of machine learning. • Explore the diverse applications of machine learning across industries. • Gain knowledge of industry-specific challenges and considerations in applying machine learning. • Develop skills in selecting and implementing machine learning algorithms for specific industry use cases. • Apply machine learning techniques to real-world datasets in different industries.			
Course Description: The Application of Machine Learning in Industries course provides students with an in-depth understanding of how machine learning techniques are applied across various industries to solve real-world problems and drive business outcomes. The course focuses on practical applications, case studies, and hands-on experience to demonstrate the potential and impact of machine learning in different sectors.			
Unit I	Why machine learning in banking sector, Use of AI in banking and finance, Fraud detection, Tough competition in banking industry, Risk modeling and investment banks, Customer data management, Decreased customer experience and loyalty, Personalized marketing, Role of machine learning: Challenges of banking sector and securities, Widely used machine learning algorithm in banking and security, Fraud prevention and detection systems, Rule based and machine learning based approach in fraud detection, Anomaly detection: Ways to expose suspicious transactions in banks, Advanced fraud detection systems, Risk management systems, Case study: Application of machine learning for financial risk management, Credit risk analysis using machine learning classifier, Investment prediction systems, Portfolio management systems, Objectives of portfolio management, Algorithmic trading, Deep learning for customer services, Chatbot: Deep learning approach, AI powered marketing systems, Deep learning in cyber security, Types of cyber-attacks in banks, Deep learning methods used in cyber security, Deep learning v/s restricted Boltzmann machines, Convolution Neural Networks (CNNs), Recurrent neural networks, Machine learning techniques: Loan underwriting & sentiment/news analysis, Sentiment or news analysis, Current challenges and opportunities: Banking and security domain.	Hours 4	
Unit II	Machine learning in communication, media and entertainment, Usage of machine learning in media and entertainment industry, Machine learning techniques for customer sentiment analysis, Word embedding's, Sentiment analysis with long short term memory networks, Real-time analytics in communication, media and entertainment industries, Real time analytics and social media, Deep learning for social media analytics, Recommendations engines, Collaborative filtering, Memory based collaborative filtering, Model based collaborative filtering, Content based filtering, Hybrid recommendation systems, Summary of recommendation systems, Deep learning techniques on recommender systems.	5	

Unit III	Applications of machine learning in health and life sciences, The most important applications of machine learning in healthcare, Role of machine learning in drug discovery, Machine learning approaches in drug discovery, Medical image analysis, Why deep learning for medical image analysis, Neural network and deep learning architecture, Comparisons between architecture of different types of deep learning models, Machine learning in genetics and genomics, Genomics and AI background, Two category of genomics, How to use deep learning effectively, Interpreting deep learning models, Predictive medicine: Prognosis and diagnostics accuracy, Predictive medicine: Examples, ML applications in breast cancer diagnosis and prognosis.	4
Unit IV	Machine learning in education, Advantages of machine learning in education, learning analytics, Academic analytics, Action research, Educational data mining, Recommender system, Personalized adaptive learning, Learning analytics process, Data environment: What? Stakeholders: Who? Methods: How? Case study: Sentimental analysis for student's feedback using ML, Recommender systems in education, Domain model, Learner model, Students classification algorithm, Recommendation model, Case study: Application of ML in predicting students' performance, Proposed methodology, Data description, Sample data sets, Visualization, Selection of machine learning technique.	5
Unit V	Introduction, Applications of machine learning in manufacturing industry, Deep learning for smart manufacturing, Machine learning for quality control in manufacturing, Case study, Construction of CNN, Experimental results, Efficiency of CNN for defect detection, Comparative experiments, Machine learning for fault assessment, Time frequency methods, Spectrograms: Short-Time Fourier Transform (STFT), Scalograms: Wavelet transform, Hilbert-Huang transform, Proposed CNN architecture for fault classification based on vibration signals, Case study, Machinery failure prevention technology, Conclusion.	4
Unit VI	Importance of machine learning in insurance, Potential use cases of machine leaning in insurance industry, Case study on insurance climb analysis using machine learning algorithms, Case study on using machine learning for insurance pricing optimization, Personalized marketing in insurance industry, Predictive model for insurance underwriting, Case study: Risk prediction in life insurance industry.	5
Unit VII	Importance of machine learning in insurance, Potential use cases of machine leaning in insurance industry, Case study on insurance climb analysis using machine learning algorithms, Case study on using machine learning for insurance pricing optimization, Personalized marketing in insurance industry, Predictive model for insurance underwriting, Case study: Risk prediction in life insurance industry.	4
Unit VIII	Introduction, Inventory management, Few use case examples, Benefits of predictive analytics to retailers, Robots-seeing to customer satisfaction, IoT: Prevention first, Predictive analytics: Weathering demand, Analysing buying patterns, Analysing traffic patterns, Assortment planning, Eliminate guess work, Feed the right stores, Get better information, Assortment planning to drive supply chain, Retail analytics, Domestic forecasting, Case study: Forecasting seasonal footwear demand using ML, Demand forecasting methods, Predictor variables in demand forecasting,	5

	Machine learning techniques used, List of attributes from the aggregated data by month at the style level, Feature selection and engineering, List of attributes for feature selection, Dataset partitioning, Model building, Three step model, K-means clustering, Three steps followed in classification, Three sub-steps in prediction, Performance measurement, Results, Three step model, Machine learning for supply chain management, Recommended architecture for machine learning models, Machine learning models use case.	
Unit IX	Introduction, Applications of ML and artificial intelligence in transportation, Applications of machine learning in transport, Incident detection, Predictive models, Application of AI in aviation and public transportation, Aviation, Shared mobility, Buses, Intelligent urban mobility, Autonomous vehicles, Autonomous transportation, Artificial intelligence use cases in logistics, Back office AI, Cognitive customs, Predictive logistics, Predictive risk management, Seeing thinking and speaking logistics operations, ML powered customer experience, Limitations of AI techniques in transportation, Computation complexity of AI algorithms.	4
Unit X	Introduction, Smart grid, Smart grid technologies, Key characteristics of smart grid, Machine learning applications in smart grid, Machine learning techniques for renewable energy generation, Forecasting renewable energy generation, Wind power generation, Solar energy generation, Hydro power generation, Determining plant location, size and configuration, Managing renewable energy-integrated smart grid, Machine learning applications in wind energy forecasting, Case study: Wind power forecasting based on daily wind speed data, Wind energy output calculations based on hourly wind speed, Machine learning techniques used, LASSO regression, KNN regression, xGBoost regression, Random forest regression, Support vector regression, Wind power forecasting method using machine learning algorithm, About data set, Case studies, Case 1: Wind power forecasting based on daily mean wind speed and standard deviation, Forecasting accuracy of algorithms, Case 2: Wind power forecasting based on only daily mean wind speed, Case 3: Wind power forecasting for a different region.	5

References:

- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.
- Applied Predictive Modeling" by Max Kuhn and Kjell Johnson.
- Machine Learning for Healthcare" by Pradeep Chowriappa.
- Machine Learning in Action" by Peter Harrington.
- Machine Learning for Dummies" by John Paul Mueller and Luca Massaro.
- Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.

Lab Exercises –

Exercise 1 - Wine Quality Prediction
Exercise 2 - Housing Price Prediction
Exercise 3 - Air Quality Prediction
Exercise 4 - Bank Marketing Campaign
Exercise 5 - Liver Disease Prediction
Exercise 6 - Heart Disease Prediction

Exercise 7 - Credit Default Prediction

Exercise 8 - Car Price Prediction

Exercise 9 - Media Content Problem

Exercise 10 - Online Retail Case Study

Exercise 11 - Airline Passengers Prediction

Exercise 12 - Energy Efficiency Analysis

Exercise 13 - Stock Price Prediction

Exercise 14 - Car Evaluation

Exercise 15 - Movie Sentiment Analysis

Semester – VI

Course Code: AIC603	Course Title: Psychology for Wellness	Credits: 3	Lectures/Week: 3
Learning Objectives: • Understand the needs of your mind • Integrate mental wellness into your daily life • Adopt techniques for improving mental wellness • Normalize the conversation on mental wellness • Help you connecting with yourself			
Course Description: This course helps in understanding your mental health needs. Learning how to balance physical & mental well-being. Practicing Techniques to Manage your Mental Health. Learning Mental Hygiene & Overcoming Stress.			
Unit I	Understanding Mental Health and Wellness • Importance and Significance • Impact on Life ○ Physical ○ Emotional ○ Mental ○ Spiritual Stress Model What Makes us the way we are • Wounds of Childhood • Defense Mechanisms • Coping Styles • Trauma Based and • Childhood Conditioning Approach	Hours 10	
Unit II	Emotional Intelligence Expressing Emotions Working with the Physical and Emotional Body • Trauma Approach Inner Child Work • Releasing Traumas • Integration and Safety Techniques to work with Emotions • Parental Stories	10	
Unit III	Building Resilience The role of Contemplative Practices and its importance - I • Self – Anchoring • Finding a Practise – Resistance and how to identify it • Changing Scripts The role of Contemplative Practices and its importance – II • Self-Anchoring Ikigai – Finding your purpose and flow Living a fulfilling life Stress Model: Physical, Emotional/Mental, Spiritual Impact Learning to Ground – to be a tree Write Down Personal Essay • Grounding Exercise • Belief Systems • Movie Review	10	

Unit IV	Emotional Awareness • Free Flowing Thoughts • Food Awareness • Cathartic Exercise – Journaling Expressing Emotions Song • Music • Poems • Drawing • Coloring • Painting • Walking • Grounding Release Emotions • Silence – Being with Self Breathwork Breathwork and Foetal Position and Journaling • Survival Tools (RPT) Bringing it together Old triggers • New Behaviours Flowing through Rhythm	10
Unit V	Practicals Essay - My biggest failure in life Movie Review - Headstrong: Mental Health and Sports Activities for expressing emotions - Prepare a report on any 5 traumas that you have experienced in your life or in the life of your family and how these traumas were overcome. Interview - Interview of a psychologist Stories discussions. - Story of Lance Armstrong Guest Lecture - Importance of mental health - Mental Health most important yet most underrated factor affecting an athlete's performance.	5
References: Psychological Factors in Competitive Sport, Don Davis, Routledge		

Semester –VI				
Course Code: AIC604	Course Title: Major Project -2		Credits: 3	Lectures/Week:3
Learning Objective:The object of Major Project -2 is to enable the student to take up investigative study in the broad field of Computer Science and Engineering , either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include: Course Description: Major Project -2 & Dissertation The object of Major Project -2 & Dissertation is to enable the student to extend further the investigative ,study either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. Major Project -2 might be a continuation to Major Project -1 or a fresh separate project for the fulfilment of the degree of Bachelor of Science.				Hours 45

SEMESTER – VI

Course Code: AIE6011	Course Title: Big Data Analytics	Credits: 3	Lectures/Week:3
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Learning Objectives:

- Demonstrates the basic operation in bigdata
- Awareness of Architectures use in bigdata
- Study about Big Data processing language Hadoop
- Describes about the modern databases
- Case studies in big data are analysed

Course Description: The subjects the fundamentals and Advanced topics of Big Data Analytics along with use cases.

Unit I	Fundamentals of Big-data analytics, Overview & analytics life cycle, Need, Structured and multi-structured data analysis, Big-data analytics major components, Analytical models and approaches, Relational and non- relational Databases, Application areas, Design and analysis of Analytics model- Analytics design steps, Understanding different data processing models, Statistical models, Predictive models, Descriptive models, Introduction to Dataanalysis using R- Basics of R Language, Statistical modelsin R, Statistical techniques applied using R, Graphical analysis techniques, Practical examples/case studies.	Hour s 12
Unit II	Analytics Using MapReduce, MapReduce design patterns, Clustered Hadoop environment, Advanced HDFS, Graph Algorithms, Searching andIndexing approaches, MapReduce Applications, Introduction to Pig and HIVE- Programming Pig: Engine for executing data flows in parallel on Hadoop, Programming with Hive: Data warehouse system for Hadoop	10
Unit III	Case Studies -Real time stream processing using MapReduce and R and Text Analytics based on different documents for identifying interesting patterns and correlations	10

References:

1. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley & Sons Inc.
2. Zantinge , "Data Mining", Pearson Education Asia
3. J. Han, M. Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann

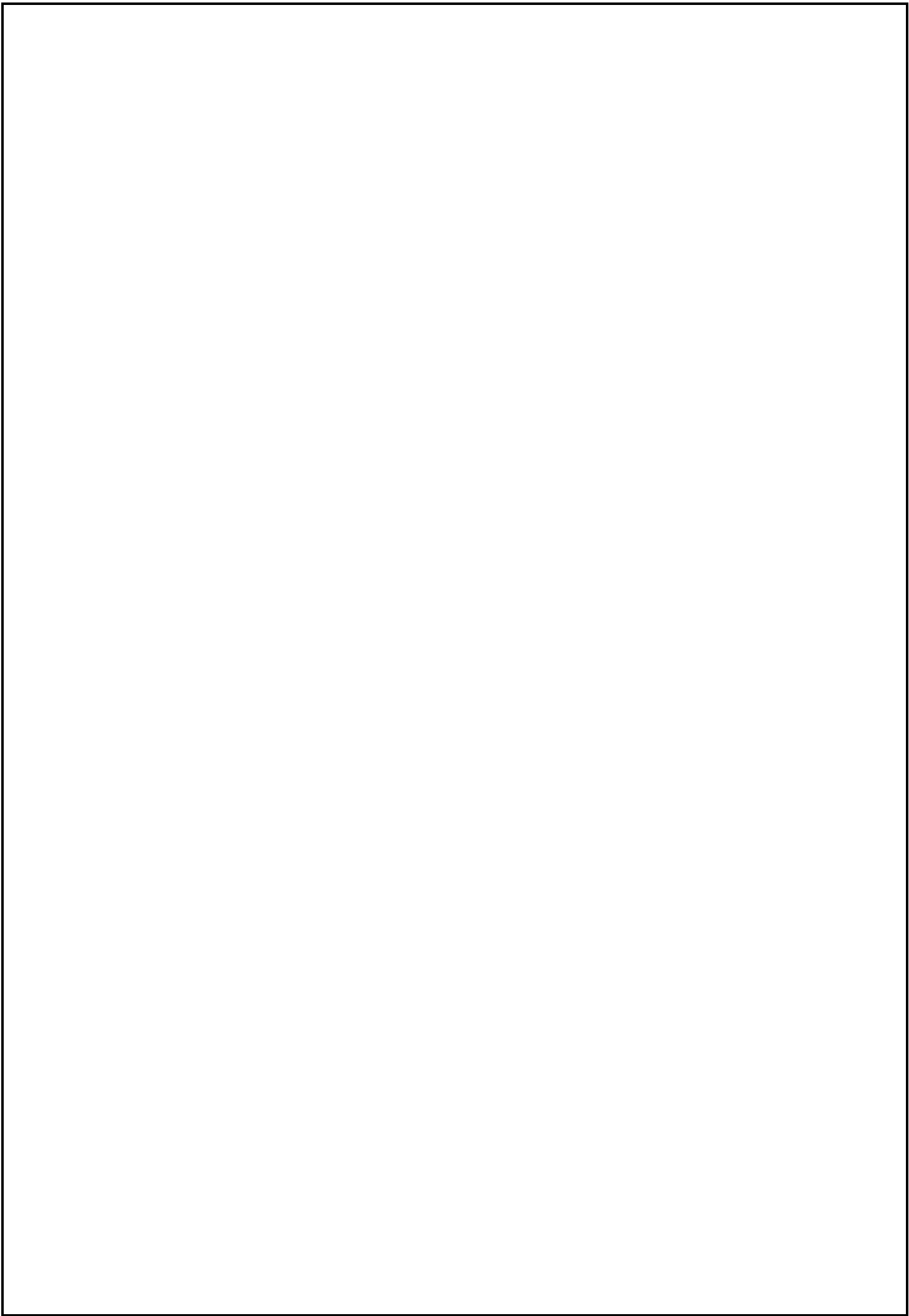
	Course Title: Big Data Analytics Lab	Duration: 13 Hours
	Topics to be covered:	3. Perform various steps of Preprocessing using WEKA software 4. Process Cube and Browse Cube Data 1. By replacing a dimension in the grid, filtering and drilldown using cube browser 2. Browse dimension data and view dimension members, member properties, memberproperty values 5. Create calculated member using arithmetic operatorsand member property of dimension Member

		6. Create and use Excel Pivot Table Report based on data cube 7. Design and Create data mining models using Analysis Service of SQL server 2005 8. Design and Build targeted mailing data mining model using analysis service of SQL server 2005 and compare their predictive capabilities using the Mining Accuracy Chart View and Create predictions using Prediction Query Builder. 9. Perform various steps of Preprocessing on the given relational database / warehouse. 10. To implement Data Mining Extensions (DMX) language and MDX query language
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Semester –VI			
Course Code: AIE6012	Course Title: Wireless Sensor Network	Credits: 3	Lectures/Week:3
Learning Objectives: Students will be learn different wireless sensor network.			
Course Description: In this course include wireless sensor network. Also study different sensors.			
Unit I	Smart Instrumentation: Materials, automation systems, sensing and Sensors, Sensor Classifications, Wireless Sensor Networks, Communication in a WSN, Important design constraints of a WSN like Energy, Self Management, Wireless Networking, Decentralized Management, Design Constraints, and Security etc.	Hours 9	
Unit II	The sensing subsystem, Analog to Digital converter, the processor subsystem, architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate Array (FPGA), comparison, communication interfaces, serial peripheral interface, inter integrated circuit, the I Mote node architecture, The XYZ node architecture, the Hog throb node architecture.	9	
Unit III	Basic components, source encoding, the efficiency of a source encoder, pulse code modulation and delta modulation, channel encoding, types of channels, information transmission over a channel, error recognition and correction, modulation, modulation types, quadratic amplitude modulation, signal propagation.	9	
Unit IV	Development of Wireless Sensor Network based on Microcontroller and communication device-Zigbee Communication device.	9	
Unit V	Structural health monitoring-sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies, multiple damage detection using mode shapes, coherence, piezoelectric effect, traffic control, health care -available sensors, pipeline monitoring, precision agriculture, active volcano, underground mining.	9	
References 1. Fundamentals of wireless sensor networks: theory and practice-Waltenegus Dargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication. 2. Smart Sensors, Measurement and Instrumentation, Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013. 3. Wireless Sensors and Instruments: Networks, Design and Applications, Halit Eren, CRC Press, Taylor and Francis Group, 2006. 4. Uvais Qidwai, Smart Instrumentation: A data flow approach to Interfacing“, Chapman & Hall; 1st Edn, December 2013. 5. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr. and Edgar C			

Semester - VI			
Course Code: AIE6013	Course Title: Computer Vision and Image Processing	Credits: 2	Lectures/Week:3
Learning Objectives: students able to learn image processing Students able to learn different image formation models.			
Course Description: In this course introduction of image processing, image formation models- projection. Also descriptive segmentation and object recognition.			
Unit I	Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content- Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality	Hours 5	
Unit II	Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection, • Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images	5	
Unit III	Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) , Edge detection. Motion Estimation : Regularization theory , Optical computation ,Stereo Vision , Motion estimation , Structure from motion	5	
Unit -IV	Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors, Medial representations , Multiresolution analysis	5	
Unit -V	Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching , Principal component analysis , Shape priors for recognition	4	
Unit -VI	Applications faces : Photo album — Face detection Face recognition Eigen Active appearance and 3D shape models of faces Application: Surveillance foreground background separation05 10 particle filters Chamfer matching, tracking, and occlusion combining views from multiple cameras human gait analysis Application: In system: locating roadway road markings — vehiclevision identifying road signs locating	6	

	pedestrians	
Reference Books: 1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill. 2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc.1992. 4. 4. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982. 5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010 6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson		



Semester –VI			
Course Code: AIE6021	Course Title: Sports Tourism	Credits: 3	Lectures/Week: 3
Learning Objectives: • Define sports tourism and differentiate it from traditional tourism models. • Analyze the motivations and characteristics of sports tourists, including participants, spectators, and event enthusiasts. • Evaluate the various forms of sports tourism, such as attending major sporting events, participating in recreational activities at a destination, or visiting sports heritage sites. • Critically assess the economic impact of sports tourism on host destinations, including job creation, infrastructure development, and revenue generation. • Develop strategies for promoting sports tourism destinations, utilizing effective marketing and communication channels. • Analyze the social and cultural impact of sports tourism, considering its potential to foster cultural exchange, build community spirit, and promote healthy lifestyles. • Evaluate the environmental impact of sports tourism events and infrastructure, exploring strategies for sustainable practices and responsible resource management. • Assess the role of technology in facilitating sports tourism experiences, including travel booking, event ticketing, and information dissemination. • Develop a comprehensive marketing plan for attracting a specific sports tourism segment to a chosen destination. • Critically analyze case studies of successful (and unsuccessful) sports tourism initiatives.			
Course Description: This course explores the dynamic intersection of sports and tourism, examining how these two powerful industries interact and influence each other. Students will delve into the motivations of sports tourists, the various types of sports tourism experiences, and the economic, social, and environmental impacts of this growing phenomenon. The course will equip students with the knowledge and skills to develop innovative strategies for marketing destinations, managing sporting events, and fostering sustainable growth within the sports tourism sector.			
Unit I	Introduction to SportsTourism Tour Operations Management Event and Logistics Psychosocial Aspects of Sports and Exercise Economic Scale of the Sports Industry Foreign Language Destination Management	Hours	9
Unit II	Tourism Marketing Cultural Tourism Tourism Transportation Itinerary Preparation and Tour Packaging Forex Management - Financial Management		9

Unit III	Recreational Tourism Tourist Behaviour and Cross-Cultural Management Tour Leadership and Management Technology Integration in Tourism Sports Tours, Sports Theme Parks, Sports Museums Sports Hall of Fame	9
Unit IV	Study Tour Reports Summer Training Reports Computer and Management Information Systems Integration Ticketing and Packages – Olympics, Wimbledon, Football	9
Unit V	Practicals Itinerary Drafting - Prepare the itinerary for FIFA U-17 Womens world cup to be held in India. The itinerary should be for one of the visiting teams. Essay Writing - Write an essay on the impact of sports on the tourism of a country. Use the example of Sri Lanka as a country. Guest Lecture - Sports Tourism Marketing Study Tour - The students will visit 2 different sports associations and study how a state level / national level tournament preparation is done.	

References:

1. Sport Tourism: Interrelationships, Impacts and Issues by James Higham and Tom Hinch
2. Understanding Sport Tourism: Concepts, Theory and Practice by Heather J. Gibson and Daniel C. Funk

Semester –VI			
Course Code: AIE6022	Course Title: Sports Entrepreneurship	Credits: 3	Lectures/Week: 3
Learning Objectives: - Identify the skills and knowledge base needed to foster entrepreneurial activity for individuals based on the experiences of successful sports entrepreneurs as well as assess and discuss the challenges they have faced. - Critically discuss ways in which entrepreneurial-minded individuals can thrive in large sports organisations despite the tendency of such organisations to resist innovation and to favour the status quo or only seek marginal gains. - Demonstrate an understanding of, and identify, new opportunities and translate them into viable business solutions or opportunities.			
Course Description: This module aims to develop, evaluate and critique entrepreneurial skills within the context of launching new products or services in the sport industry. It will also be of benefit for entrepreneurs who are looking to flourish within existing organisations.			
Unit I	Nature and Importance of Entrepreneurship and mind set, intentions of corporate entrepreneurship. Types of Entrepreneurships Sport as a catalyst for Entrepreneurs in Sport Characteristics of individual entrepreneurs in sport Entrepreneurialism within large sporting Organisations	Hours	9
Unit II	Identifying opportunities for innovation in sport Structuring the sports start-up Funding and resourcing a sports start-up		9
Unit III	Managing growth and existing within the sports industry Generating and exploiting new entries, and creativity and the business idea Domestic and International opportunities and legal issues Business Plan, and Marketing plan Organizational Plan, Financial Plan Sources of Capital, and informal risk capital, venture capital and going public Strategies for growth and accessing resources for growth from external sources Succession planning and strategies for harvesting and ending the Venture		9

Unit IV	Business Plan Online Sports Entrepreneurship Magazine	9
Unit V	Practical Guest Lecture - Identifying opportunities for innovation in sport Movie Review - 22 Yards, Million Dollar Arm Preparation of business plan - Prepare a business plan for a new business start up idea in the field of sports. Presentation - Present any one successful business model in the e-sports industry.	9

References:

- "Sports Entrepreneurship: Theory and Practice" edited by Vanessa Ratten and João J. Ferreira
- "The Sports Business as a Career" by William F. Stier Jr.

Semester – VI			
Course Code: AIE6023	Course Title: Digital Media and Marketing	Credits: 3	Lectures/Week: 3
Learning Objectives: On successful completion of the module, the student should be able to: • Evaluate the theory pertaining to issues in sports promotion and sponsorship and formulate appropriate communication strategies within a sport industry setting, for a team or product. • Explain the fundamental concepts and processes of marketing promotion and communication in sport and evaluate the role of social media in the promotion of sports. • Explain and evaluate different types of sports promotion and communication strategies with emphasis on sport sponsorship and social media and the targets they are relevant for.			
Course Description: Sports promotion, through sports sponsorship and marketing communications, has increased in importance over the last few years due to the need to create revenues and to disconnect from state funded sources. The module concentrates primarily on the objectives of marketing communication of brands (that can refer to products, teams, venues and athletes) that invest in sport promotion and the strategies and tools to achieve these objectives. The approach combines the advancement of new methods of promotion through traditional offline methods and digital methods with emphasis to social media to attract participants (athletes), buyers (fans) and sponsors.			
Unit I	Overview of principles of marketing and communication as they relate to the sports industry - Target audiences (consumers, athletes, businesses) - Sports integrated communication - Sports Sponsorship - Sports web marketing - Social media marketing - Design and implementation of campaigns What is sports marketing? Sports Marketing: differences and similarities with other marketing	Hours	S

Unit II	Fundamentals of Digital Marketing and Advanced SEO - Pay-per-click (PPC) - Web Analytics - Digital Marketing Capstone Project Social Media Marketing - Facebook - YouTube - Website - Instagram - Snap chat/Tiktok/Takatak - Weibo - LinkedIn Affiliate and Influencer Marketing Email Marketing	
Unit III	Value: sponsorship, partnership and dynamic ticket pricing Sports Communication: Press Releases, Media Relations, Public Relations - SEO Optimization - Introduction to CRM - Competitor and Website Analysis - Market Research and Niche Potential - Content Creation, Management and Promotion - Introduction to Web Analytics - Mobile Marketing - Social Media Marketing - Digital Marketing Budgeting, Planning and Forecast - Digital Marketing Project Management - Product Marketing (Facebook, Instagram, Google Ads) - Website Data Analytics - Paid Ads Optimization Strategies - Neuro-Marketing Fundamentals	

1. Lagae, W. (2005) Sports Sponsorship and Marketing Communications: A European Perspective. Essex, UK: Pearson Education Limited.
2. Newman, T., Peck, J. & Harris C. (2013) Social Media in Sport Marketing, Scottsdale, AZ: Holcomb Hathaway Publishers.

RECOMMENDED READING :

A. Books

1. Pelsmacker, P., Geuens, M. & van den Bergh, J. (2007) Marketing Communications: A European perspective, 4th Edition, Essex, UK: Pearson Education Limited.
2. Shank, M. (2008) Sports Marketing: A Strategic Perspective, 4th Edition, Upper
i. Saddle River, NJ: Pearson.
3. Shilbury, D., Westerbeek, H., Quick, S. & Funk, D. (2009) Strategic Sport Marketing, Crows Nest, AU: Allen and Unwin.

B. Articles

1. Ferrier, S., Waite, K. & Harrison, T. (2013) "Sports sponsorship perceptions: An exploration", Journal of Financial Services Marketing, 18(2), 78-90.
2. Farrelly, F. (2010) "Not Playing the Game: Why Sport Sponsorship Relationships Break Down", Journal of Sport Management, 24(3), 319-337.
3. Hutchins, B. & Rowe, D. (2010) "Reconfiguring Media Sport for the Online World: An Inquiry Into "Sports News and Digital Media"", International Journal of Communication, 4, 696-718.
4. Moore, A. J. (2011) "Go for the goal: How pro sports teams score with social media", Public Relations Tactics, 18(3), 11.
5. Pronschinske, M., Groza, M. & Walker, M. (2012) "Attracting Facebook Fans': The Importance of Authenticity and Engagement as a Social Networking Strategy for Professional Sport Teams", Sport Marketing Quarterly, 21(4), 221- 231.
6. Price, J., Farrington, N. & Hall, L. (2013) "Changing the game? The impact of Twitter on relationships between football clubs, supporters and the sports media", Soccer & Society, 14(4), 446-461.
7. Schultz, B. & Sheffer, M. (2011) "Factors Influencing Sports Consumption in the Era of New Media", Web Journal Of Mass Communication Research, 37. Retrieved from <http://www.scripps.ohiou.edu/wjmcr/vol37/>.

C. Web Resources

1. Journal of Sports Management www.nassm.com
2. Journal of Sports Management and Marketing www.inderscience.com
3. Journal of Sports Marketing and Sponsorship
www.imrpublicorshipations.com
4. North American Association of Sports Management www.nassm.com
5. Sport Marketing Quarterly www.marketingpower.com
6. European Association of Sport Management www.easm.net
7. Sport Marketing Association www.sportmarketingassociation.net

Evaluation Scheme

Continuous Assessment (C.A.) -

C.A. – I: Test – Rubric to assess

C.A. – II:

Organization and Development of Ideas	Analysis and Evaluation

Semester End Examination (SEE) -

Passing marks shall be 40% for all subjects compulsorily.

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