

University of Mumbai



AAMS_UGS /ICC/2022-23/ 93

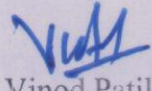
CIRCULAR:-

Sub :- B.Sc (Artificial Intelligence & Sports Analytics)

Ref :- RB/MU-2022/CR-207/Edn-5/899, dated 18th August, 2022.

All the Principals of the Affiliated Colleges, the Head of the University Department and Directors of the recognized Institutions in Faculty of Interdisciplinary Studies are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Centre of Excellence in Sports Science & Sports Management** at its online meeting held on 3rd November, 2021 vide item No. 3 and subsequently passed by the Board of Deans at its online meeting held on 9th November, 2021 vide item No. 9.7 have been accepted by the Academic Council at its meeting held on 10th November, 2021, vide item No. 6.9 (4N) and subsequently approved by the Management Council at its meeting held on 30th December, 2021, vide item No. 3 and 25th May, 2022 vide item No. 6 and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the Ordinance 6767 & 6768 Regulations 9519 to 9521 and the syllabus of **B.Sc (Artificial Intelligence & Sports Analytics) Sem I & II (CBCS)** has been introduced and the same have been brought into force with effect from the academic year **2021-22**, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
20th August, 2022
To,


(Dr. Vinod Patil)
I/c. REGISTRAR

The Principals of the Affiliated Colleges, the Head of the University Department and Directors of the recognized Institutions in Faculty of Interdisciplinary Studies.

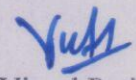
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20th August, 2022

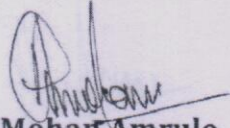
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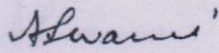
- 1) The Chairman, Board of Deans
- 2) The Dean, Faculty of Interdisciplinary Studies,
- 3) The Chairman, Ad-hoc Board of Studies in Centre of Excellence in Sports Science & Sports Management,
- 4) The Director, Board of Examinations and Evaluation,
- 5) The Director, Department of Students Development,
- 6) The Director, Department of Information & Communication Technology,
- 7) The Co-ordinator, MKCL.


(Dr. Vinod Patil)
I/c REGISTRAR

AC - 10/11/2021Item No. 6.9 (4)**UNIVERSITY OF MUMBAI****Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course O: <u>6767</u>	B.Sc. (Artificial Intelligence Sports Analytics)
2	Eligibility for Admission O: <u>6768</u>	Passed 10+ 2 standard with 45% with mathematics as a core /elective subject. Marks scheme of any recognized State/Central/International Board .
3	Passing Marks R: _____	50%
4	Ordinances / Regulations (if any)	
5	No. of Years / Semesters R: _____	3 years/ 6 Semester
6	Level	Under Graduate(U.G)
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic Year	From Academic Year: 2021-22


Mr. Mohan Amrule
 Chairman of BoS


Dr. Anita Swami
 Dean, Interdisciplinary

O.No: 6767

Title of the course - B.Sc. (Artificial Intelligence and Sports Analytics)

O.No: 6768

Eligibility: Passed 10+2 standard with 45 % with mathematics as a core/elective subject.
Marks scheme of any recognized State/Central/International Board

R: _____

R-9519

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: -

Periodical class tests/presentations held in the given semester (30 Marks)

Attendance and Active participation in routine class instructional deliveries (05 Marks)

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

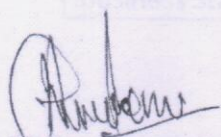
Q7 Any two from (a) or (b) or (c) ----- (5x2) = 10 Marks

R: 9520

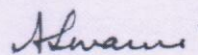
Standard of Passing: A Student has to separately secure minimum 50% marks (i.e. 20 out of 40) in the internal assessments and secure minimum 50% marks (i.e. 30 out of 60) in the Semester End Examination in every subject to be declared as Pass.

R-9521

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



Mr. Mohan Amrule
Chairman of BoS



Dr. Anita Swami
Dean, Interdisciplinary

Copy to :-

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

for information.

UNIVERSITY OF MUMBAI



Program: Undergraduate Degree Program

Course: B.Sc. (Artificial Intelligence & Sports Analytics)

SEMESTER - I & II

(As per Choice Based and Credit System)

(Introduced with effect from the academic year 2021-22)

AC - 10/11/2021Item No. 6.9 (4)**UNIVERSITY OF MUMBAI****Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course O: _____	B.Sc. (Artificial Intelligence Sports Analytics)
2	Eligibility for Admission O: _____	Passed 10+ 2 standard with 45% with mathematics as a core /elective subject. Marks scheme of any recognized State/Central/International Board
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5	No. of Years / Semesters R: _____	3 years/ 6 Semester
6	Level	Under Graduate(U.G)
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic Year	From Academic Year: 2021-22

Mr. Mohan Amrule
Chairman of BoS

Dr. Anita Swami
Dean, Interdisciplinary

O.No: _____

Title of the course - B.Sc. (Artificial Intelligence and Sports Analytics)

O.No: _____

Eligibility: Passed 10+ 2 standard with 45 % with mathematics as a core/elective subject.
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R: _____

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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

R: _____

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



Mr. Mohan Amrule
Chairman of BoS



Dr. Anita Swami
Dean, Interdisciplinary

BSc.(Artificial Intelligence and Sports Analytics)

Semester – I & II

SEMESTER – I	CREDITS
COURSE	
CORE	
Mathematics for Intelligent System 1	2
Communication	3
Accountancy	3
Principles of Management	3
SCHOOL ELECTIVES 2/5	
Introduction to Basic Electrical Engineering	2
Principals of Electronics	2
Intelligence of Biological Systems 1	2
Problem Solving and Object-Oriented Programming	3
Formal Language and Automata Theory	3
SPECIAL ELECTIVES 1/2	
Sports Law	3
Introduction to Computer Science	3

SEMESTER - II	CREDITS
COURSE	
CORE	
Mathematics for Intelligent System 2	2
Database Management System	3
Macro Economics	3
Human Resource Management	3
SCHOOL ELECTIVES 2/5	
Operation Research and Optimization Techniques	2
Discrete Mathematics	2
Computer Organization and Architecture	2
Strategic Management	3
Data Structures and Algorithms	2
SPECIAL ELECTIVES ½	
Managing Stakeholder in Sports	2
Business Statistics	3

Semester – I			
Course Code: TIMUAIS1C1	Course Title: Mathematics for Intelligent System 1	Credits: 2	Lectures/Week:3
Learning Objectives: - To develop an understanding of the basic concepts and techniques of linear algebra as applied to signal processing. - To provide an appreciation of these disciplines within the scientific field. To provide connection between the concepts of linear algebra, differential equation and probability theory.			
Course Description: This objective of this course is to provide a focus on linear algebra,vector spaces and convolution theory.			
Unit I	Basics of Linear Algebra - Linear Dependence and independence of vectors - Gaussian Elimination - Rank of set of vectors forming a matrix - Vector space and Basis set for a Vector space - Dot product and Orthogonality - Rotation matrices - Eigenvalues and Eigenvectors and its interpretation - Projection matrix and Regression – Singular Value Decomposition.	Hours 12	
Unit II	Convolution sum, Convolution Integral, Ordinary Linear differential equations, formulation, analytical and Numerical solutions, Impulse Response Computations, formulating state space models of Physical systems.	8	
Unit III	Examples of ODE modelling in falling objects, satellite and planetary motion, Electrical and mechanical systems. Multivariate calculus, Taylor series, Introduction to Optimization. Introduction to Probability Distributions and Monte Carlo Simulations	10	
References: 1. Reena Garg, Engineering Mathematics-I, Khanna Publishers. 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. 3. Michael Greenberg, Advanced Engineering Mathematics, Pearson. 4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers. 5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning. 6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi. 7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd. 8. Hoffman and Kunze: Linear algebra, PHI.			

SEMESTER – I			
Course Code: TIMUAI51C2	Course Title: Communication	Credits: 3	Lectures/Week:3
Learning Objectives: • Provide a basic understanding of the fundamentals of communication in a business setting • Develop English language skills –both oral and written • Ensure good presentation skills			
Course Description: On a daily basis we work with people who have different opinions, values, beliefs, and needs than our own. Our ability to exchange ideas with others, understand others' perspectives, solve problems and successfully utilize the steps and processes presented in this training will depend significantly on how effectively we are able to communicate with others. Hence it becomes imperative to have some understanding of the complex and dynamic structure of modern communication and develop communication skills.			
Unit I Scope of Communication	Meaning, Nature, Scope, Definition of Communication, Types of Communication, Communication Barriers, Principles of Communication. Written Communication – Types of Letter, Letter lay-out, Essentials of an effective letter writing, Need and function of Business letter.	Hours 7	
Unit II Oral & Writing	Oral Communication – Types of oral communication, Barriers to oral communication, speedy – Introduction & Characteristic of good speech. Mass Communication – Nature & Scope of Mass Communication, function of mass communication – Media of mass communication	10	
Unit III Report Writing/Written Communication	Report Writing - What is report, Importance of Reports, Types of reports, Characteristic of good report selecting suitable types of reports.	10	
Unit IV	Writing a publishable article for a newspaper Presentations – in group and in person on topics given in class Group discussions	18	
References: • Business Communication – Monopoly & Monipally • Commercial Correspondence – Ghosh & Bhushan			

SEMESTER – I			
Course Code: TIMUAI51C3	Course Title: Accountancy	Credits: 3	Lectures/Week:3
Learning Objectives: • The present course includes introduction to the subject of Financial Accounting, basic concepts underlying the accounting practices and its techniques with special reference to Sole- Proprietorship. • It also touches upon the various aspects of accounting related to Non-Trading Concerns.			
Course Description: Financial Accounting as a discipline has evolved over the years due to the perennially changing requirements of the industry. With the advent of computerization, it now also encompasses new techniques and new issues caused by changes in the legislations pertaining to the preparation and publication of Financial Statements.			
Unit I	Accounting, meaning, definition, objectives, scope, basic, terms, accounting principles, branches of accounting, uses & limitations of Accounting, Concepts & Conventions, Accountings use, Accounting information, Accounting equations – Meaning of accounting equation, compensation of accounting, effects of transactions.	Hours 10	
Unit II	Basic Accounting Procedure – Journal, rules of debit & credit, method of journalizing, advantage, double entry system – its advantage, ledger, meaning, utility, posting entries. Practical system of book keeping – Cashbook, types of cash book, Single column, double column, entries, Trial Balance, Objective, preparation, errors & rectification, Suspense Accounting – meaning, utility & preparation.	15	
Unit III	Bank Reconciliation: - Meaning, causes of differences, need & importance, preparation & presentation of BRS, Depreciation – meaning, methods of charging depreciation, straight line, written - down methods. Statements Final Accounts – Meaning, need & objectives, types – Trading Account – Meaning, need & preparation, Profit & loss Account – meaning, Need & preparation, Balance Sheet- Meaning, need & Preparation, Final Accounts with adjustment entry.	15	
Unit IV	Case studies on successful accounting firms and on accounting frauds that were made public Reading, analysing and presentation	5	
References: • Basics of Accounting – Jain & Narang • Basic of Accounting – T. S. Grewal • Accounting for Managers – J. Made Gowda – Himalaya Publishing House • Introduction to Accountancy – T. S. Grewal & S. C. Gupta – S. Chand – 8th Edition • Modern Accountancy - Hanif Mukerji – TMH • Financial Accounting by Dr. Kaustubh Sontake – 1st Edition – Himalaya Publishing House			

SEMESTER – I			
Course Code: TIMUAIS1C4	Course Title: Principles of Management	Credits: 3	Lectures/Week:3
Learning Objectives: • This subject is designed to provide a basic understanding to the students with reference to working of business organizations through the process of management. • The first part of this course will give a brief understanding of the managerial functions of planning (including decision making) and organizing. • The second part (HRM) will throw light on the managerial functions of staffing, directing and controlling.			
Course Description: The field of management has undergone a sea change and has today assumed a form of a profession with a well-defined body of knowledge. This knowledge is continuously evolving and new issues and findings are constantly emerging. This field is attracting many people who want to undergo a formal training in this area. This course is designed to give individuals a precursor into the world of management and its expectations.			
Unit I Evolution of Management	Evolution of Management: - Contribution of Taylor, Mayo & Fayol, Different approaches o management, role of manager, tasks of a professional manager, Management & its functions. Level of Management, managerial skills at various levels. Planning & Decision making: - Definition, Nature for planning, importance, Process of planning, decision making, nature importance & process, types of plans.	Hours 10	
Unit II Organization, Planning & Decision Making	Organization & staffing: - Definition, organizing process, importance of organizing, Departmentation manpower planning, Recruitment, Selection, Training & promotion. Directing & Leadership: - X Theory, & Y Theory, Hawthorne & Tinstone studies Leadership. Definition, Stogdill trait theory, Managerial grid, Fiedlers contingency approach.	15	
Unit III Motivation & leadership	Motivation – Meaning, Missions, Herzberg’s theory, V Room’s expectancy theory & Porter & Lawler model of Motivation. Communication & control Communication Definition, importance, process, types, factors affecting communication methods, barriers & remedies.	15	
Unit IV	Games: - Decision Making - Fayol’s 14 Principles of Management – Game - Game on Team work explaining efficacy - Using Maps for Leadership Models Using Kirkpatrick Model for Leadership Development - Compete Game – Business Acumen + High Performing Teams + Collaborative Working + Negotiating Skills	5	

	4 lectures (2 hours each + Presentations)	
References: • Principles & Practice of Management – L. M. Prasad • Management – Theory & Practice – C. B. Gupta • Karminder Ghuman and K. Aswathapa; Management – Concept, Practice and Cases; Tata McGraw Hill; 1st edition (2010) • Gupta, Sharma and Bhalla; Principles of Business Management; Kalyani Publications; 1st edition		

SEMESTER – I			
Course Code: TIMUAIS1SCE1	Course Title: Introduction to Basic Electrical Engineering	Credits: 2	Lectures/Week:3
Learning Objectives: • Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context. • Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices. • To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments. • Highlight the importance of transformers in transmission and distribution of electric power			
Course Description: The objective of this courses to provide the students a basic knowledge of electrical engineering including basic of motors,machines , transformation and distribution of power.			
Unit I	DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits	Hours 5	
Unit II	AC Circuits Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	7	
Unit III	Transformers Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	6	
Unit IV	Electrical Machines Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	6	
Unit V	Power Converters DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation. Module 6: Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup	6	

References:

1. V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication
3. Chakrabarti, Nath & Chanda, Basic Electrical Engineering, TMH
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education

Reference books

1. H. Cotton, Willey Press
2. J.B. Gupta, Basic Electrical Engineering, Kataria & Sons .
3. Kothari & Nagrath, Basic Electrical Engineering, TMH

SEMESTER – I			
Course Code: TIMUAIS1SCE2	Course Title: Principals of Electronics	Credits: 2	Lectures/Week:3
Learning Objectives: - Acquire a pre requisite knowledge on basic electrical technology and to familiarise with basic electronic devices - Enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences. It enables the students to learn fundamental characteristics of science as human enterprise and apply scientific methods independently.			
Course Description: The objective of this courses to provide the students a basic knowledge of electronics including transistors, semiconductors, FETs, oscilators.			
Unit I	Classification of solids based on energy band theory, Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Half and Full wave rectifiers, Zener effect, Zener diode, Zener diode Characteristics, Zener diode as a regulator.	Hours 8	
Unit II	Bipolar junction transistors – CB, CE, CC configurations and characteristics, Biasing circuits – Fixed bias, Voltage divider bias, CE amplifier, Concept of feedback, Negative feedback, voltage series feedback amplifier, Current series feedback amplifier	7	
Unit III	FET – Configuration and characteristics, FET amplifier, Characteristics and simple applications of SCR, Diac, Triac and UJT	7	
Unit IV	Positive feedback, Sinusoidal oscillators – RC phase shift, Hartley, Colpitts, Wein bridge oscillators, Operational amplifier – Adder, Inverting and Non-inverting amplifiers, integrator and differentiator, IC 555 based Astable and Monostable Multivibrators.	8	
References: 1. Analog and Digital Communication Singal, T. L. Tata Mcgraw Hill, India latest edition 2. Electronic Communication Systems George Kennedy and Bernard Davis Tata McGraw Hill 5th edition or latest 3. Electronics Communication Dennis Roddy and John Coolen Pearson Eductation 4th Edition 4. Electronics Communication System (Fundamental to Advance) Wayen Tomasi Pearson Education, 5th edition			

SEMESTER – I			
Course Code: TIMUAIS1SCE3	Course Title: Intelligence of Biological Systems 1	Credits: 2	Lectures/Week:2
Learning Objectives: - To introduce the basics of cell biology which will pave way for advanced courses in computational biology. - To help the students understand the basic cellular processes and it will provide a very basic introduction about intelligence of the cell.			
Course Description: The objective of this courses to provide the knowledge of computational biology.			
Unit I	Classification of biological macromolecules, Cellular Structures	Hours 10	
Unit II	Cellular Energy Production and Utilization, The Cell Cycle and Cell Division, Meiosis and Formation of Gametes,	12	
Unit III	Protein Synthesis, Gene Expression and Mutation, Evolution Patterns and Processes.	8	
References: - Ryan Rogers, Cell and Molecular Biology for Environmental Engineers, Momentum Press Engineering, 2018. - Gabi Nindl Waite, Lee R. Waite, Applied Cell and Molecular Biology for Engineers, McGraw Hill Publishers, 2007.			

SEMESTER – I			
Course Code: TIMUAIS1SCE4	Course Title: Problem Solving and Object-Oriented Programming	Credits: 3	Lectures/Week:3
Learning Objectives: - To introduce the concepts of Object Oriented Programming and to understand develop and implement efficient programs using java. - To Learn how to use these object-oriented programming concepts in code examples, discover how these concepts are used in applications that require user input, and understand the benefits of these concepts in Java			
Course Description: The objective of this courses to provide the students a in depth knowledge object oriented systems, operations with the concepts relating to OOP terminologies using the programming language Java.			
Unit I	OOP concept Object, Class, Data abstraction, Data encapsulation, Inheritance, Polymorphism, Dynamic binding	Hours 5	
Unit II	Module II: Overview of Java and Data concept Java features, JVM, Comparison between Java and C++, Idea of any Java Development Kit (JDK). Data Types, variables, scope and life time of variables, Identifiers, Literals, Keywords, Operator.	5	
Unit III	Control, iteration statements and array Simple if statement, if...else statement, nesting of if-else statement, switch statement. For loop, while loop, Do-While loop, Arrays, 1D and 2D array	4	
Unit IV	Method parameters, Inheritance and String Methods with parameters, Methods with a return type, Method overloading, Passing Objects as Parameters, Passing Values to methods and Constructor, Abstract classes, Basic concepts, types of inheritance, use of super keyword, overriding methods, String buffer, different string functions.	6	
Unit V	Packages, Interfaces and Exception Handling User defined package, import package, Class path, how to create interface, use and extend interface, what is Exceptions and handling exception? Compile time errors Run time errors, try...catch, Using Multiple Catch Blocks, finally Block, throwing an Exception, Using the throw and throws Statement.	6	
Unit VI	Stream, Multithreaded Programming, Applets, Concept of Abstract Window Toolkit Byte Streams, Input Stream, Output Stream Character Streams (Reader, Writer), How Files and Streams Work, working with Reader classes (Input Stream Reader, Buffered Reader), Overview, Thread Life cycle, Advantages of multithreading over multi-tasking Thread Creation and simple programs, Synchronized thread, Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, how to run applet. GUI Components Labels, Buttons, Check Boxes, Radio button, Text Area, Text Field, Scrollbar, Panels, Layout managers, Simple event driven programming with Text Field and Button.	6	

References:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – PrenticeHall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Name:: Problem Solving and Object-Oriented Programming Lab	No of Labs : 13 (each lab duration 1 hour)
Objective List of Programs	• To implement , run and debug java programs • To implement structures like constructors,overloading, inheritance, overriding • To implement threads, applets
	• Assignments on class, constructor, overloading, inheritance, overriding • Assignments on wrapper class, arrays • Assignments on developing interfaces- multiple inheritance, extending interfaces • Assignments on creating and accessing packages • Assignments on multithreaded programming • Assignments on applet programming Note: Use Java for programming

SEMESTER – I			
Course Code: TIMUAIS1SCE5	Course Title: Formal Language and Automata Theory	Credits: 3	Lectures/Week:3
Learning Objectives: • Be able to construct finite state machines and the equivalent regular expressions. • Be able to prove the equivalence of languages described by finite state machines and regular expressions • Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars. • Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines			
Course Description: The objective of this courses to provide the students a knowledge of theory of computation including regular expressions, finite and non finite automata, context free language.			
Unit I	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	Hours 7	
Unit II	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, non deterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	10	
Unit III	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.	9	
Unit IV	Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators	10	
Unit V	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages	9	
References: 1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia. 2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.			

3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B.Patel, Theory of Computation, Khanna Publishing House

SEMESTER – I			
Course Code: TIMUAIS1SPE1	Course Title: Sports Law	Credits: 3	Lectures/Week:3
Learning Objectives:			
Course Description:			
Unit I Types of Laws	• Various sources of Law, significance of law, business law • Impact of law on society & business economics • Constitution aspects and implications	Hours 10	
Unit II Contracts and norms	• Law of Contract – Definition & Nature of Contract, types of contract, offer & acceptance, consideration & capacity to contract, free constant legality of object & consideration, contingent contract, quasi contract discharge of contract, remedies for breach of contract, indemnity & guarantee • Pledge principal – agent relationship & rights & obligation of Principal & agent.	15	
Unit III	• Law of sale of goods – nature of contract of sale, conditions & warranties, Transfer of ownership • Performance of contract of sale, rights of unpaid seller, Remedies for breach of contract Auction sale • Law of negotiable instruments – nature of N. I., Promissory notes, BOE, Cheque, Parties of NI	15	
Unit IV	• Court of Arbitration in Sports (CAS) - Duttee Chand Case, Shanti Case - Watch a movie - File a compliant, Caster Semenya Case. Maria Sharapova Case, Icarius movie review, Athlete A movie Review, Lance Armstrong - The Program, Dig out Files and Do Review. Tour de France.	5	
References: Requisite case studies and learning material to be provided			

SEMESTER – I			
Course Code: TIMUAIS1SPE2	Course Title: Introduction to Computer Science	Credits: 3	Lectures/Week:3
Learning Objectives: - To understand the basic concept of working principles of Computer, history of computer - To understand the concepts pf hardware, softwares involved - To understand the concept of computer networks, databases including data mining and data warehousing			
Course Description: The main objective of this course is to provide students knowledge of fundamental concepts of computers and information technology.			
Unit I	1. Introduction to Computer teaching hours: Introduction; Digital and Analog Computers; Characteristics of Computer; History of Computer;Generations of Computer; Classification of Computer; The Computer System; Application of Computers 2. The Computer System Hardware teaching hours: Introduction; Central Processing Unit; Memory Unit; Instruction Format; Instruction Set;Instruction Cycle; Microprocessor; Interconnecting the Units of a Computer; Inside a Computer Cabinet 3. Computer Memory Introduction; Memory Representation; Memory Hierarchy; CPU Registers; Cache Memory; Primary Memory; Secondary Memory; Access Types of Storage Devices; Magnetic Tape; Magnetic Disk; Optical Disk; Magneto-Optical Disk; How the Computer uses its memory		Hours 15
Unit II	4. Input and Output Devices Introduction; Input-Output Unit; Input Devices; Human Data Entry Devices; Source Data Entry Devices; Output Devices; I/O Port; Working of I/O System 5. Data Representation Introduction; Number System; Conversion from Decimal to Binary, Octal, Hexadecimal; Conversion of Binary, Octal, Hexadecimal to Decimal; Conversion of Binary to Octal,Hexadecimal; Conversion of Octal, Hexadecimal to Binary; Binary Arithmetic; Signed and Unsigned Numbers; Binary Data Representation; Binary Coding Schemes; Logic Gates 6. Computer Software		15

	Introduction; Types of Software; System Software; Application Software; Software Acquisition; Operating System (Introduction, Objectives of Operating System, Types of OS, Functions of OS, Process Management, Memory Management, File Management, Device Management, Protection and Security, User Interface, Examples of Operating Systems)	
Unit III	7. Data Communication and Computer Network Introduction; Importance of Networking; Data Transmission Media; Data Transmission across Media; Data Transmission and Data Networking; Computer Network; Network Types; Network Topology; Communication Protocol; Network Devices; Wireless Networking 8. The Internet and Internet Services Introduction; History of Internet; Internetworking Protocol; The Internet Architecture; Managing the Internet; Connecting to Internet; Internet Connections; Internet Address; Internet Services; Uses of Internet; Introduction to Internet of Things (IoT), Wearable Computing, and Cloud Computing, Introduction to E-commerce, E-governance, and Smart City, and GIS 9. Fundamentals of Database Introduction; Database; Database System; Database Management System; Database System Architectures; Database Applications; Introduction to Data Warehousing, Data mining	15
References: 1. "A First Course in Computers" by Sanjay Sexena 2. "Introduction To Computers" by Ms Shikha Nutiyal 3. "Introduction to Information Technology" by Rajaraman V 4. "Introduction to Information Technology: ITL Education Solutions Limited" by ITL ESL		

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

BSc (Artificial Intelligence and Sports Analytics)**Semester – I & II**

SEMESTER – I	CREDITS
COURSE	
CORE	
Mathematics –I	2
Communication -1	3
Accounting -1	3
Principles of Management	3
SCHOOL ELECTIVES 2/5	
Introduction to Basic Electrical Engineering	2
Principals of Electronics	2
Intelligence of Biological Systems 1	2
Problem Solving and Object-Oriented Programming	3
Formal Language and Automata Theory	3
SPECIAL ELECTIVES ½	
Sports Law	3
Introduction to Computer Science	3

SEMESTER - II	CREDITS
COURSE	
CORE	
Mathematics for Intelligent System 2	2
Database Management System	3
Macro Economics	3
Human Resource Management	3
SCHOOL ELECTIVES 2/2	
Operation Research and Optimization Techniques	2
Discrete Mathematics	2
Computer Organization and Architecture	2
Strategic Management	3
Data Structures and Algorithms	2
SPECIAL ELECTIVES 1/2	
Managing Stakeholder in Sports	2
Business Statistics	3

SEMESTER – II			
Course Code: TIMUAI52C1	Course Title: Mathematics for Intelligent System 2	Credits: 2	Lectures/Week:3
Learning Objectives: - Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines. - Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions - Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems			
Course Description: The objective of this course to provide the students a knowledge of Sequence and series, matrices, vector spaces.			
Unit I	Sequence and Series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem	Hours 7	
Unit II	Multivariate Calculus: Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	7	
Unit III	Matrices: Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation	5	
Unit IV	Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank- Nullity theorem, composition of linear maps, Matrix associated with a linear map	6	
Unit V	Vector Spaces (Continued): Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	5	
References: 1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.			

2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

SEMESTER – II			
Course Code: TIMUAIS2C2	Course Title: Database Management System	Credits: 3	Lectures/Week:3
Learning Objectives: - To understand the different issues involved in the design and implementation of a database system. - To study the physical and logical database designs, database modeling, relational, hierarchical, and network models - To understand and use data manipulation language to query, update, and manage a database - To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing. - To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. - To understand the different issues involved in the design and implementation of a database system.			
Course Description: The objective of this course is to introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems			
Unit I	Database system architecture: Data Abstraction, Data Independence, Data Definition Language(DDL),Data Manipulation Language(DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations	Hours 4	
Unit II	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms	9	
Unit III	Storage strategies: Indices, B-trees, hashing	8	
Unit IV	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multiversion and optimistic Concurrency Control schemes, Database recovery	6	

Unit V	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	4
References: 1. Database System Concepts” , 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill. 2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press. 3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)		

Database Management System Lab	14 hours
Topics to be covered:	Structured Query Language 1. Creating Database • Creating a Database ¶ Creating a Table ¶ Specifying Relational Data Types ¶ Specifying Constraints ¶ Creating Indexes 2. Table and Record Handling INSERT statement ¶ Using SELECT and INSERT together ¶ DELETE, UPDATE, TRUNCATE statements ¶ DROP, ALTER statements 3. Retrieving Data from a Database 1. The SELECT statement 2. Using the WHERE clause 3. Using Logical Operators in the WHERE clause 4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause 5. Using Aggregate Functions 6. Combining Tables Using JOINS 7. Subqueries 8. Database Management ¶ Creating Views ¶ Creating Column Aliases ¶ Creating Database Users ¶ Using GRANT and REVOKE

SEMESTER – II			
Course Code: TIMUAI52C3	Course Title: Macroeconomics	Credits: 3	Lectures/Week:3
Learning Objectives: • Overview of economic models with special emphasis on the Indian economy • Introduction to policies and policy making • Understanding the economic cycle			
Course Description: This course is intended to provide students with an overarching view of how the economy functions. Economic models and policies are introduced in the framework of the Indian economy to make it relevant for students to understand and relate to.			
Unit I	• Overview of Indian Economy, Trends towards market economy, problems of underdevelopment – • meaning, Main problems, reasons, of underdevelopment. Development- Factors and measure, Meaning of • Economic development, National income, Per capital income, Quality of life, Capital Formation – • Savings, Investment.	Hours 8	
Unit II	• Planning in India, Meaning, Importance, Main reasons of adopting, planning in India, Objectives of • planning, Economic development, moderation, stability, self sufficiency, employment etc, foreign aid, • Employment. Allocation of Resources, Private and Public Sector, Public Sector – role and growth, • Achievements of the public sector, Private Sector – Importance Problems, New foreign Trade Policy	14	
Unit III	• Present Economic Policy, Main feature, Globalization, Expansion of Private sector, more market orient • approach. Public distribution system, Industrial policy – 1948, 1956, 1977, 1980, 1990, 1991, 2000- 2001 • Industrial Licensing, Monetary and Fiscal Policy.	14	
Unit IV	Case studies on policy making Market survey activities to understand real world economic cycles	9	
References: • Indian Economy- A. N. Agarwal • Indian Economy – Mishra & Puri • Indian Development and planning – M. L. Jhingan • Indian Economy – R. S. Rastogi • Yozna and Kurukshetra Magazines			

SEMESTER – II			
Course Code: TIMUAIS2C4	Course Title: Human Resource Management	Credits: 3	Lectures/Week:3
Learning Objectives: - Understanding functioning of human resource in an organizational setting - Understanding different components of a job in the work place			
Course Description: This course is specifically designed for students to be introduced to the work environment outside of the school and college environment that they are used to. This course is a stepping stone to creating managers as well as efficient employees in the workplace.			
Unit I	Natural and scope of HRM- Meaning, function, objective, scope, internal & external HRD in India, Human Resource Planning of Development – Meaning Factors effecting HRP Planning Process.	Hours 10	
Unit II	Job Analysis and Job design requirement, selection placement training & development. Compensation – Performance Appraisal, Job evaluation, remuneration, incentive payments, employed benefits and specious.	10	
Unit III	Employee Welfare – Welfare measure, safety and health, promotion transfer Grievances in India Industry. Industry relation and industrial disputes in India their resolution, role of trade union, working participation in Management.	11	
Unit IV	HBR case studies – reading, analysing and presentations Negotiation exercise in class – group activity	14	
References: - Human Resources Development – Rao, Verma Khandelwal - Human Resources Development – Nadler & Lenonard - Dessler, G. Fundamentals of Human Resource Management (4th Edition, Pearson)			

SEMESTER – II			
Course Code: TIMUAIS2SCE1	Course Title: : Operation Research and Optimization Techniques	Credits: 2	Lectures/Week:3
Learning Objectives: • To study the various Operations Research tools, • To study to apply an appropriate model to the given situation. • To formulate the problem. • To solve and analyze the problems on Operations Research.			
Course Description: The objective of this courses to provide the students a knowledge of optimization techniques including linear programming problems , network analysis, game theory.			
Unit I	Introduction to OR Modeling Approach and Various Real Life Situations	Hours 3	
Unit II	Linear Programming Problems (LPP) : Basic LPP and Applications ; Various Components of LP Problem Formulation	5	
Unit III	Solving Linear Programming Problems : Solving LPP : Using Simultaneous Equations and Graphical Method ; Simplex Method ; Duality Theory ; Charnes’ Big – M Method . Transportation Problems and Assignment Problems	5	
Unit IV	Network Analysis : Shortest Path : Dijkstra Algorithm ; Floyd Algorithm ; Maximal Flow Problem 7L (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded) .	7	
Unit V	Inventory Control : Introduction ; EOQ Models ; Deterministic and probabilistic Models ; 5L Safety Stock ; Buffer Stock.	5	
Unit VI	Game Theory : Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and 6L Maxi-Min Theorems (statement only); Games without saddle point ; Graphical Method ; Principle of Dominance	5	
References: 1. H.A. Taha, “ Operations Research”, Fifth Edn. Macmillan Publishing Company, 1992. 2. Kanti Swaroop – “ Operations Research” 3. Hadley G., “Linear Programming” Narosa Publishers, 1987 4. Hillier F.& Liebermann G.J., “Operations Research”, Holder Day Inc, 1974			

SEMESTER – II			
Course Code: TIMUAIS2SCE2	Course Title: Discrete Mathematics	Credits: 2	Lectures/Week:3
Learning Objectives: • Use mathematically correct terminology and notation. • Construct correct direct and indirect proofs. • To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees • Use counterexamples. Apply logical reasoning to solve a variety of problems			
Course Description: The objective of this courses to provide the students a basic knowledge of sets, relations, functions, propositional logic, algebraic structure and morphism.			
Unit I	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well- Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic		Hours 7
Unit II	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination		4
Unit III	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency		6
Unit IV	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form		7

Unit V	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances	6
References: 1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation 2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI 3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning 4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH 5. J.K. Sharma, Discrete Mathematics, Macmillan 6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON. 7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press. 8. Douglas B. West, Introduction to graph Theory, PHI.		

SEMESTER – II			
Course Code: TIMUAIS2SCE3	Course Title: Computer Organization and Architecture	Credits: 2	Lectures/Week:3
• Learning Objectives: To understand the structure, function and characteristics of computer systems. • To understand the design of the various functional units and components of computers. • To identify the elements of modern instructions sets and their impact on processor design. • To explain the function of each element of a memory hierarchy, • To identify and compare different methods for computer I/O.			
Course Description: The objective of this courses to provide the students basic organization of stored program computer and operation sequence , ALU and CU organization.			
Unit I	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes	Hours 8	
Unit II	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. Design of ALU.Fixed point multiplication - Booth's algorithm. Fixed point division - Restoring and non-restoring algorithms. Floating point - IEEE 754 standard.	6	
Unit III	Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization, static and dynamic memory, memory hierarchy, associative memory. Cache memory, Virtual memory. Data path design for read/write access.	8	
Unit IV	Design of control unit - hardwired and microprogrammed control. Introduction to instruction pipelining. Introduction to RISC architectures. RISC vs CISC architectures. I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.	8	
References: 1. Mano, M.M., “Computer System Architecture”, PHI. 2. BehroozParhami“ Computer Architecture”, Oxford University Press 3. N. senthil Kumar, M. Saravanan, S. Jeevananthan, “Microprocessors and Microcontrollers” OUP 4. Chaudhuri P. Pal, “Computer Organisation & Design”, PHI,			

5. P N Basu- “Computer Organization & Architecture” ,Vikas Pub

Semester -II			
Course Code: TIMUMSS2C4	Course Title: Strategic Management	Credits: 3	Lectures /Week: 3
Learning Objectives - Analyse the main structural features of an industry and develop strategies that position the firm most favourably in relation to competition and influence industry structure to enhance industry attractiveness. - Demonstrate understanding of the concept of competitive advantage and its sources and the ability to recognize it in real-world scenarios.			
Course Description: This course introduces the key concepts, tools, and principles of strategy formulation and competitive analysis. It is concerned with managerial decisions and actions that affect the performance and survival of businesses. The course is focused on the information, analyses, organizational processes, and skills and business judgment managers must use to devise strategies, position their businesses, define firm boundaries and maximize long-term profits in the face of uncertainty and competition.			
Unit I	Significance of Planning – types, needs, requisites, corporate planning system – approach, role of planner, corporate planning & budgeting, corporate responsibility Vs profitability and productivity. Corporate Objective – concept of corporate purpose, mission, objectives and goals process of setting corporate objectives. Forces intersecting with corporate objectives external and internal.	10	
Unit – II	Strategy Formulation – identifying strategic alternatives of business, objectives and goals, environmental appraisal – concept and components evaluation and strategic option key involved in the evolution. Strategy implementation – Introduction to growth strategies. Diversification, acquiring, merger and joint venture.	10	
Unit – III	Organizing the strategies implementation operations, developing production, marketing and financial strategies.	11	

	Organizational apparition – dynamics, capacity, factors consideration, methods and techniques and structuring gaps analysis, manager, audit and significance of gap.	
Unit – IV	Strategic management performance systems case studies Guest lectures In-class scenarios and role play	14
References Grant, R. and Jordan, J. 2012. Foundations of Strategy. NY: John Wiley & Sons, Ltd. Case studies as required.		

SEMESTER – II			
Course Code: TIMUAIS2SCE5	Course Title: Data Structure and Algorithms	Credits: 2	Lectures/Week:3
Learning Objectives: • To understand data organization, deletion, traversal and other related terminologies • To understand linear and non-linear data structures like stacks, queues, linked lists, trees • To understand searching and sorting techniques			
Course Description: The objective of this courses to provide the students a in depth idea of storing and organizing data including linear and non – linear data strutures			
Unit I	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	Hours 4	
Unit II	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – correspondionalgorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, CircularQueue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	5	
Unit III	Linked Lists: Singly linked lists: Representation in memory, Algorithms of severaloperations: Traversing, Searching, Insertion into, Deletion from linked list; Linkedrepresentation of Stack and Queue, Header nodes, Doubly linked list: operations on it andalgorithmic analysis; Circular Linked Lists: all operations their algorithms and thecomplexity analysis.	5	
Unit IV	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and theiralgorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree:definitions, algorithms and analysis.	4	
Unit V	Sorting and Hashing: Objective and properties of different sorting algorithms:Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort;Performance and Comparison among all the methods, Hashing.Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis	3	
References:			

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by ReemaThareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Data Structure and Algorithm Lab	No of Lab required: 9(1 hours each)
LIST OF PROGRAMS:	• To write, test, and debug data structure programs • To implement linear data structures • To implement non-linear data structure • To implement searching sorting algorithms • Implementation of array operations: Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : • Evaluation of expressions operations on Multiple stacks & queues : • Implementation of linked lists: inserting, deleting, inverting a linked list. • Implementation of stacks & queues using linked lists: Polynomial addition, Polynomial multiplication Sparse Matrices Multiplication, addition. • Recursive and Non-recursive traversal of Trees Threaded binary tree traversal. AVL tree implementation Application of Trees. • Application of sorting and searching algorithms Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

SEMESTER – II			
Course Code: TIMUAIS1SPE1	Course Title: Managing Stakeholder in Sports	Credits: 2	Lectures/Week:3
Learning Objectives: • To understand the structure, goal and resources of the old and new actors in the sports world • To be able to draw a map of the Olympic stakeholders and be familiar with the acronyms of major sports organisations • To understand people, leadership and how operations can be best understood from that lens.			
Course Description: Human capital is a key factor of corporate performance. On completion of this course, participants should be able to explain why and how various stakeholders/ human factors influence performance in several professional situations, at individual, interpersonal and organizational levels			
Unit I	Stakeholder Theory: - Managerial Decision-Making about Stakeholders - Conceptual Framework - Previous Stakeholder Management Research Methods ○ Research Sample ○ Research Design ○ Data Collection ○ Data Analysis ○ Validity and Reliability - Identifying Stakeholders and Stakeholder Characteristics ○ Stakeholder Prioritization ○ Stakeholder Relationship Characteristics		Hours 10
Unit II	Managing Operations, People and Leadership: - Analysis of types of Sports Operations - Planning, managing and evaluating operational resources (Operating Environment, Nature, Governance, Management of Change). - Critical Awareness of complexities of Human Resource Management - Leadership Theory as applied to Sports Organizations - Importance of Stakeholders, collaborators and delivery in a sports organization - Case Study on Olympics and the organizational structure involving multiple stakeholders for smooth operations (Stakeholders of the Olympic System). - Corporate Diplomacy - Information Management and Information Technology		11

Unit III	Communication and Stakeholder Management: - Strategic Management (Human Resource Management, Developing Strategy, Recruiting and Motivating, Development through training, developing skills) - Legislations, Policy, Governance Effective Communication Strategies - Analyse the value of effective communication and stakeholder management practices across different contexts - Determine appropriate tools and strategies for managing individuals, teams and organizations - Performance Management and Performance Measurement - Analyse how effective performance management can improve the health of a team, organisation or business - Use of technological developments and data management practices to improve communication amongst stakeholders.	10
Unit IV	Case Study: - Importance of ethics and sportsmanship (working towards a common goal) - Unique Business challenges posed through sports - Solve sports management challenges in a real-world context using key business principles - Investigate business aspects of sports management within your community or organisation. - Volunteer Management System - Accreditation Systems - Organising Amenities, Sites and Spaces.	11

References:

1. Pot N, Schenk N, Van Hilvoorde I. School sports and identity formation: Socialisation or selection? European Journal of sport science. 2014;14(5):484-91. [DOI:10.1080/17461391.2013.873483] [PMID]
2. Ho D, Lee M. Capacity building for school development: current problems and future challenges. School Leadership & Management. 2016;36(5):493-507. [DOI:10.1080/13632434.2016.1247040]
3. Hogan A, Stylianou M. School-based sports development and the role of NSOs as 'boundary spanners': benefits, disbenefits and unintended consequences of the Sporting Schools policy initiative. Sport, Education and Society. 2018;23(4):367-80. [DOI:10.1080/13573322.2016.1184638]
4. Freeman RE. Divergent stakeholder theory. Academy of management review. 1999;24(2):233-6. <https://doi.org/10.2307/259078> [DOI:10.5465/amr.1999.1893932]
5. Phillpots L. An analysis of the policy process for physical education and school sport: the rise and demise of school sport partnerships. International journal of sport policy and politics. 2013;5(2):193-211. [DOI:10.1080/19406940.2012.666558]

SEMESTER – II			
Course Code: TIMUAIS2SPE2	Course Title: Business Statistics	Credits: 3	Lectures/Week:3
Learning Objectives:			
Course Description:			
Unit I	Introduction to Statistics – Origin, meaning and purpose of statistics. Scope and limitations of statistics. Science or Art and sit rust of statistics. Collection and presentation of data. Sources and methods of data collection. Principles of data classification. Tabulation of data. Frequency Distributions and measures of central tendency – Frequency Distribution and graphic representation of frequency distributions. Measures of Central Tendency – Arithmetic Geometric and Harmonic mean. Mean Mode, Merits and demerits of Mean, Mode and Median Measures of Variations – Skewness and Dispersion.	Hours 15	
Unit II	Correlation and Regression Analysis: Introduction to Correlation and Regression. Simple linear regression model and coefficients of regression. Correlation Analysis – Significance and types of correlation, Methods of Correlation analysis – Scatter, diagram Karl Pearson’s, coefficient, Rank correlation and method of least squares, standard Error of estimates, Time series Analysis – Introduction, Utility of time series analysis, Components and analysis of time series. Measuring Trends of time series, semi-average, moving averages and method of least squares.	15	
Unit III	Sampling Theory – Introduction to sampling, purpose, principles and method of sampling. Types of sampling, sample size, sampling and Non-Sampling errors, Central limit theorem. Tests of Hypothesis. Index numbers their characteristics and untidy. Methods of constructing Index numbers, problems in construction of Index Numbers Limitation soft Index numbers.	15	
References: • Business Statistics – S. P. Gupta & M. P. Gupta • Statistical Methods – S. P. Gupta & M. P. Gupta • Statistic for Management – Jit, Chandan Das			

FEE STRUCTURE

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	1,61,592	7,00,000	1,61,592	1,61,592	-	1,61,592
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	2,15,000	7,53,408	2,15,000	2,15,000	53,408	2,15,000

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	1,61,592	7,00,000	1,61,592	1,61,592	-	1,61,592
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	2,15,000	7,53,408	2,15,000	2,15,000	53,408	2,15,000

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	1,61,592	7,00,000	1,61,592	1,61,592	-	1,61,592
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	2,15,000	7,53,408	2,15,000	2,15,000	53,408	2,15,000

Justification for introducing various new courses in the University of Mumbai

B.Sc. (Artificial Intelligence and Sports Analytics)

1. Necessity of Starting the course

Considering the huge demand and supply gap of skilled professional in the industry especially in the domain of emerging fields like Artificial Intelligence and Data Science; it is evident that skilled professionals in the same domain will be high in demand in the industry. Considering this, these courses are designed to create skilled, industry ready young talents. The courses are also designed keeping in mind the modern tech stacks of AI and Data science highly used in industry. These new gen courses also focus on applications of AI and Data science in the domain of sports where also skilled techies are highly required. Moreover the courses are designed as per NEP -2020 standard facilitating the students to go through interdisciplinary subjects.

2. Whether UGC has recommended starting the courses

Yes, it has been recommended due to the rapid growth of the sports industry.

3. Whether all the courses have commenced from the academic year 2021-22?

No, it shall commence 2022 onwards

4. The courses started by the University are self-financed, whether an adequate number of eligible permanent faculties are available?

Yes, the courses are self-financed and faculties are available. They are a combination of academic, international and industry experts.

5. To give details regarding the duration of the course and is it possible to compress the course?

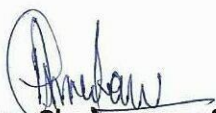
The duration of the course is for 3 years and it is not possible to compress. A detailed understanding of Artificial intelligence and Sports Analytics will be provided to the students.

6. The intake capacity of each course and no. of admissions given in the current academic year (2021-22)

The proposed batch size is 60 students. However, if there is increase in demand, can increase the batch size to up to 120 students

7. Opportunities of Employability/ Employment available after undertaking these courses?

Post completion of the courses the students will have opportunities in industry as Machine learning engineer, Data Science Engineer, Data Analyst, Sports Analyst, Data Analyst, Product Analyst, and Machine Learning



Signature Chairman of BoS

Mr. Mohan Amrule