University of Mumbai

AAMS_UGS /ICC/2022-23/94

CIRCULAR:-

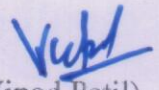<u>Sub :- B.Sc (Data Science and Sports Studies)</u>

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

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 <u>vide</u> item No. **3** and subsequently passed by the Board of Deans at its online meeting held on 9th November, 2021 <u>vide</u> item No. **9.7** have been accepted by the Academic Council at its meeting held on 10th November, 2021, <u>vide</u> item No. **6.9 (5N)** and subsequently approved by the Management Council at its meeting held on 30th December, 2021, <u>vide</u> item No. 3 and 25th May, 2022 <u>vide</u> 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 **6769 & 6770** Regulations **9522 to 9524** and the syllabus of **B.Sc (Data Science and Sports Studies) 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.
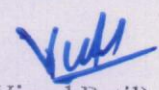
A.C/6.9 (5N)/10/11/2021
M.C/6/25/05/2022

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AAMS_UGS/ICC/2022-23/94   20th August, 2022

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 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,
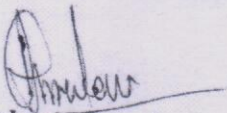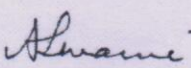7) The Co-ordinator, MKCL.

(Dr. Vinod Patil)
I/c. REGISTRAR

AC – 10/11/2021

Item No. 6.9 (5N)

UNIVERSITY OFMUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course O: 6769	B.Sc. (Data Science and Sports Studies)
2	Eligibility for Admission O: 6770	Passed 10+ 2 standard with 45% with mathematics as a core /elective subject. Marks scheme of any recognized State/Central/International Board
3	PassingMarks 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: __6769__

<u>Title of the course</u> - B.Sc. (Data Science and Sports Studies)

O.No: __6770__

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

R: _____

R- 9522   <u>Scheme of Examination</u>

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)

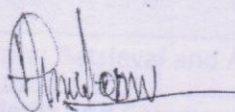Attempt Any Four out of the Remaining Six Q2 – Q6 = 10 Marks

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

R: __9523__

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- 9524

Intake Capacity: The maximum intake capacity of B.Sc. (Data Science and Sports Studies) 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 Walfare (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. (Data Science and Sports Studies)

SEMESTER - I & II

(As per Choice Based and Credit System)

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

UNIVERSITY OFMUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course O: _____	**B.Sc. (Data Science and Sports Studies)**
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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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: _____

Title of the course - B.Sc. (Data Science and Sports Studies)

O.No: _____

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

R:_____

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The Semester End Examination will be conducted for 60 Marks each subject Internal Assessments will be conducted for 40 Marks each subject

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Attendance andActive participation in routine class instructional deliveries(05Marks)
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Q1 = 20 Marks (Compulsory)

Attempt Any Four out of the Remaining Six Q2 – Q6 = 10 Marks

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R:_____

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

Mr. Mohan Amrule
Chairman of BoS

Dr. Anita Swami
Dean, Interdisciplinary

BSc. (Data Science and Sports Studies)

Semester – I & II

SEMESTER - I	CREDITS
COURSE	
CORE	
Mathematics –I	3
Communication	3
Accountancy	3
Principles of Management	3
SCHOOL ELECTIVES 2/5	
Introduction to IT	2
Principals of Electronics	2
Digital Logic	2
Problem Solving Through Programming	3
Fundamental of Internet of Things	3
SPECIAL ELECTIVES ½	
Sports Law	3
Culture and heritage of Sports	2

SEMESTER - II	CREDITS
COURSE	
CORE	
Mathematics-II	2
Strategic Management	3
Macro Economics	3
Human Resource Management	3
SCHOOL ELECTIVES 2/5	
Data Science: An Introduction	2
Python Programming	2
Data Structure and Algorithm	2
Formal Language and Automata Theory	2
Business Ethics	3
SPECIAL ELECTIVES ½	
Sports Data: Retrieval and Analysis: An Introduction	3
Sports Media and Communication	3

Semester –I			
Course Code: TIMUDSS1C1	**Course Title: Mathematics-1**	**Credits: 2**	**Lectures /Week: 3**

Learning Objectives
- Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
- Understand the domain of applications of mean value theorems to engineering problems.
- Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
- Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
- Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

Course Description: : The main objective of this course is to provide students knowledge of calculus, probability , distribution and statistics.

Unit I	Calculus (Integration): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	5
Unit – II	Module -2 Calculus (Differentiation): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	5
Unit – III	Module-3 Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	5
Unit -IV	Module -4 Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
Unit -V	Module-5	5

	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	
Unit -VI	Module-6 Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	6

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: TIMUDSS1C2	**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.	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: TIMUDSS1C3	**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.	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	5

	Reading, analysing and presentation	

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: TIMUDSS1C4	**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.	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 4 lectures (2 hours each + Presentations)	5

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: TIMUDSS1SCE1	**Course Title: Introduction to IT**	**Credits: 2**	**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 Computerteaching 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 Hardwareteaching 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 | 6 |
| 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 | 8 |

	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 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	6
Unit – IV	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	5

	2. The Computer System Hardwareteaching 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	
Unit -V	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 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)	5

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

Semester -I			
Course Code: TIMUDSS1SCE2	**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, oscillators.

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.	10
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	6
Unit – III	FET – Configuration and characteristics, FET amplifier, Characteristics and simple applications of SCR, Diac, Triac and UJT.	8
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.	6

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: TIMUDSS1SCE4	**Course Title: Problem Solving through Programming**	**Credits: 2**	**Lectures /Week: 3**

- **Learning Objectives** :
- Develop efficient algorithms for solving a problem.
- Use the various constructs of a programming language viz. conditional, iteration and recursion. • Implement the algorithms in "C" language.
- Use simple data structures like arrays, stacks and linked list in solving problems.
- Handling File in "C"

Course Description: The objective of this courses to provide the students a knowledge of c programming environment to create , implement and debug programs.

Unit I	Introduction to Programming : How to develop a program, Algorithms, Flow-charts, Types of Programming Languages,Compiler and Linker, Testing and Debugging a program, Documentation	2
Unit – II	Constants, Variables & Data Types : Character set, C Tokens, Identifiers and Keywords, Constants, Variables, Data types,Declaration of variables, declaration of storage class, assigning values to variables, defining symbolic constants, declaring a variable as constant, declaring a variable as volatile, overflow and underflow of data	2
Unit – III	Operators and Expressions: Arithmetic operators, Relational, Logical operators, Assignment, increment and decrement operators, conditional operators, bitwise operators, special operators, arithmetic expressions, evaluation of arithmetic expressions, precedence of arithmetic expressions, some computational problems, type conversion in expressions, operator precedence and associativity, mathematical functions	3
Unit -V	Managing Input & output operations: Reading a character, writing a character, formatted input, formatted output. Decision Making – Branching & Looping Hrs. Decision making with IF statement, switch statement, ? : operator, goto statement. While statement, do-while statement, for statement, Jumps in loops,	2
Unit -VI	Arrays and Strings: One dimensional array: Array Manipulation, Different operations on one dimensional arrays, two dimensional array, operations on two	2

	dimensional arrays, multi-dimensional array, dynamic arrays Declaring and initializing string variables, reading string from terminal, writing string to screen, putting strings together, comparison of two strings, string handling functions, table of strings	
Unit -VII	Functions: Top down approach of problem solving, standard library functions, passing values between functions, scope rules of functions, calling convention, return type of functions, call by value and call by reference, recursive functions. Storage Classes Scope and extent, Storage Classes in a single source file: auto, extern and static, register	3
Unit- VIII	Structures and Unions: Defining a structure, Declaring Structure variables, accessing structure members, structure initialisation, copying and comparing structure variables, operation on individual members, arrays of structures, arrays within structures, structures and functions, union, size of structure, bit fields.	3
Unit - IX	Understanding pointers, accessing the address of a variable, declaring pointer variables, initialisation of pointer variables, accessing a variable through its pointer, chain of pointers, pointer expression, pointer increment and scale factor, pointer and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers and structures.	2

References
1. E. Balagurusamy, "Programming with ANSI-C", Fourth Edition,2008, Tata McGraw Hill.
2. R.G. Dromey, "How to solve it by Computer", Pearson Education, 2008.
3. Kanetkar Y, "Let us C", BPB Publications, 2007.
4. Hanly J R &Koffman E.B, "Problem Solving and Programm design in C", PearsonEducation, 2009.

Course Name: Problem Solving Through Programming Lab	9 Hours(1 e Hours each lab)
Objective	- To create , implement and debug C programs - To understand if-else, control statements - To understand implementations of functions - To implement array, pointers, structures, structures
Topics to be covered	Lab1: Familiarization with programming environment

	• Lab 2: Simple computational problems using arithmetic expressions • Lab 3: Problems involving if-then-else structures • Lab 4: Iterative problems e.g., sum of series • Lab 5: 1D Array manipulation • Lab 6: Matrix problems, String operations • Lab 7: Simple functions • Lab 8 and 9: Programming for solving Numerical methods problems, Pointers

Semester -I			
Course Code: TIMUDSS1SCE5	**Course Title:** Fundamental of Internet of Things	**Credits:** 2	**Lectures /Week: 2**

Learning Objectives :
- Understand general concepts of Internet of Things (IoT)
- Recognize various devices, sensors and applications
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

Course Description: This objective of this courses is to provide a knowledge of internet of things including sensors and their applications, design concept of ioT solutions.

Unit I	Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.	8
Unit – II	M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT,	6
Unit – III	IoT Reference Architecture- Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction, Technical design Constraints	8
Unit - IV	Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT application.	8

References
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

Semester -I			
Course Code: TIMUDSS1SPE1	**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		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: TIMUDSS1SPE2	**Course Title:** Culture and Heritage of Sport	**Credits: 1**	**Lectures/Week:**

Learning Objectives:

1. To provide opportunities to students to deepen their knowledge of core culturalinsights into sport and how it impacts us.

2. To equip students with knowledge and history and heritage of sports

3. To introduce to them how sport is a level playing field above all for humanity

Course Description:
Introduction to the concept of culture and heritage of sport and why it is essential in the growth and development of sport

Unit I	**Introduction and Critical Approaches**	**Hours**
	1. Sports organizations: Social Class and the Evolution of Sports Organizations	5
	2. News Reports: Communicating the story	
	3. Sports, Social Norms, and social change:	
	4. Issues of race	
	1. Issues of Gender	
	2. The Inside Story: Sports Diaries, Race, and Social Values	
	3. Media, Fans and Sports in the Home	
	4. Sports Television and Radio	
	5. Sports and Film: Sports Myth and Reconstructing Race, Gender and Patriotism in Sports Films	
Unit II	Introduction of Competition in sports:	
	1. The Olympic Games	6
	2. Origins and Evolution of the Game	
	3. Dynasties and Rivalries Legends and Traditions	
	4. Civil Rights and Sports	
	5. Defining the Impact and role of sports	
Unit III	Cultural Identity and the Sports World:	5
	- Globalization	
	- Nationalism	

	- Politics	
	- Cultural Identity	
	- Rise of Women in Sports	
	You Run like a girl	
	- Why do we care so much about sports?	
	- Mega business of sports?	
	- Preservation through sport	
	- Search for Adventure	
	- Disabilities of sport	
	- Accidental Role Models	
	- When race, religion and sport collide	
	- Tales of Human Spirit	

Unit IV	Traditional Sports and Games:
	- Intangible Cultural Heritage
	- Past to Future pathway
	- Empowering People towards Peaceful Societies
	    o Olympic Solidarity
	    o UN's Stand on Olympics
	    o Youth Empowerment
	    o Intercultural Dialogue
	    o Recognition and Safeguarding
	    o Sport for Development and Peace
	    o Legacy Planning
	    o Sustainability
		6

Unit V	• Visit to a sports infrastructure • Report on legacy planning and sustainability • Management and restoration • Use and upgradation of technology	
References:		

BSc (Data Science and Sports Studies)

Semester – I & II

SEMESTER – I	CREDITS
COURSE	
CORE	
Mathematics –I	3
Communication -1	3
Accounting -1	3
Principles of Management	3
SCHOOL ELECTIVES 2/5	
Introduction to IT	2
Principals of Electronics	2
Digital Logic	2
Problem Solving Through Programming	3
Fundamental of Internet of Things	3
SPECIAL ELECTIVES ½	
Sports Law	3
Culture and heritage of Sports	2

SEMESTER - II	CREDITS
COURSE	
CORE	
Mathematics-II	2
Strategic Management	3
Macro Economics	3
Human Resource Management	3
SCHOOL ELECTIVES 2/5	
Data Science: An Introduction	2
Python Programming	2
Data Structure and Algorithm	2
Formal Language and Automata Theory	2
Business Ethics	3
SPECIAL ELECTIVES 1/2	
Sports Data: Retrieval and Analysis:an Introduction	3
Sports Media and Communications	3

Semester –II			
Course Code: TIMUDSS2C1	**Course Title: Mathematics-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 courses 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	6
Unit – II	Multivariate Calculus: Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangmultivariate calculus, ent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	6
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	6
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	7
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.

Semester -II			
Course Code: TIMUDSS2C2	**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: TIMUDSS2C3	**Course Title:** Macro Economics	**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.	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 Devlopment and planning – M. L. Jhingan
- Indian Economy – R. S. Rastogi
- Yozna and Kurukshetra Magazines

	Semester -II		
Course Code: TIMUDSS2C4	**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.	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: TIMUDSS2SCE2	**Course Title: Python Programming**	**Credits: 2**	**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	3
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	4
Unit - III	Tuple Introduction, Accessing tuples, Operations, Working, Functions and Methods Dictionaries Introduction, Accessing values in dictionaries, Working with dictionaries,Properties	5
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	6
Unit -V	Exception Handling Exception, Exception Handling,Except clause, Try ? finally clause, User Defined Exceptions	3

Reference
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 Title: Python Programming Lab	**No of Lab required: 9(1 hour each)**
Objective	• 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 –II			
Course Code: TIMUDSS2SCE3	**Course Title: Data Structure and Algorithm**	**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:			
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.	4	
Unit -II	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – correspondingalgorithms 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	

Reference
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.

Course Title: Data Structure and Algorithm Lab	No of Lab required: 9(1 hour each)
Objective	• To write, test, and debug data structure programs • To implement linear data structures • To implement non-linear data structure • To implement searching sorting algorithms
LIST OF PROGRAMS:	• 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 Nonrecursive 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: TIMUDSS2SCE4	**Course Title:** Formal Language and Automata Theory	**Credits:** 2	**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.	4
Unit – II	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic 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)	6
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.	8
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,	6

	unrestricted grammars and equivalence with Turing machines, TMsas enumerators	
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	6

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 o
   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 -II		
Course Code: TIMUMSS1SCE5	**Course Title:** Business Ethics	**Credits:** 2	**Lectures /Week: 2**

Learning Objectives
- Introduce students to the concept of ethical dilemmas
- Encourage critical thinking
- Develop an ethical compass

Course Description: This course is designed to introduce students to the possibility that the world is not demarcated clearly into black and white. We all deal with grey situations where our ethical compass shall lead us to take informed decisions. Also, an introduction to the laws of the land and ethical digressions in society and particular streams.

Unit I Concepts and Values	• Ethics and Business Ethics • Concepts Values and Ethic	10
Unit – II Corporate Ethics	• Ethical Corporate Behaviour • Development of corporate ethics • Ethical Leadership • Ethical Decision-making	10
Unit – III Functional Ethics	• Ethical Dilemmas in Organization • Social Responsibility of Business • Corporate Governance	10
Unit- IV Corruption and Gender Issues	• Ethic in Functional Area • Marketing, Finance, Human Resource and Information Technology • Environmental Ethics • Corruption and Gender Issues—Gender Ethics, Sexual Harassment and Discrimination.	10
Unit – V	• Role play of ethical issues – group discussions • Mock court cases of ethical dilemmas	5

Semester -II			
Course Code: TIMUDSS2SPE1	**Course Title: Sports Data: Retrieval and Analysis an Introduction**	**Credits: 3**	**Lectures /Week: 3**

Learning Objectives
- To Understand basic data mining techniques for retrieval
- To understand data types, quality and descriptive data summarization, integration and reduction
- To under understand the cluster analysis techniques

Course Description: The main objective of this course is to provider students a in depth knowledge of retrieval, cleaning and analysis using various techniques of data mining and analysis.

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	10
Unit – II	Introduction: Data Mining Concept, Origin, Process, Applications, Techniques, Challenges Data Pre-processing: Data types, Quality, Descriptive data summarization – central tendency and dispersion measure, Data cleaning, Data integration & transform, Data reduction	10
Unit – III	Association Rule Mining: Market-basket analysis basics, Naïve algorithm, Apriori algorithm, Direct Hashing and Pruning (DHP), Software for Association Rule Mining Classification and Prediction: Decision Tree, Classification by decision tree induction, Bayesian classification, Rule-based classification, Prediction – Linear and Nonlinear Regression, Classification software	15
Unit -IV	Cluster Analysis: Types of data in cluster analysis, Partitioning methods, Hierarchical methods, Density-based methods, Quality & Validity of clustering methods	10

References:
1. Tan, Steinbach and Kumar, Introduction to Data Mining, Pearson
2. Han and Camber, Data Mining: Concepts and Techniques, Morgan Kaufmann
. Foreman, Data Smart: Using Data Science to Transform Information into Insight, John Wiley
4. Dunham, Data Mining : Introductory and Advanced Topics, Pearson

Semester II			
Course Code: TIMUDSS2SPE2	**Course Title: Sports Media and Communications**	Credits: 3	Lectures Week:

Learning Objectives
1. Learning basics of sports journalism
2. Understanding media and communication's role in sports

Course Description
This course allows students to best understand the relationship of media and sports.

Module I	Introduction to Sports Writing:
	- Rules that universally apply to all kinds of journalism
	- How sports writing is slightly different and why?
	- Evolution of sports journalism and communication
	    o How sports became a specialised beat
	    o Radio and TV coverage of sports
	    o Social Media
	    o Challenges
		15

Module II	Covering sports, the tool kit - How watching sport as a journalist or media professional is different from watching it as a fan - Areas that you must concentrate on - Tool required to make a difference - Sports photography Sports Writing II - Writing a match report - Writing a preview, review of the entire event - Post-match interviews - Profile stories - Other possible stories from the event	16
Module III	Business of Sports - Covering the financial aspect of events - Structure of sports federations and internal politics - The sports equipment industry	15
Module IV	Planning coverage of a sports event - Media centre - Coverage Plan - Press Releases - Sponsors Commitment	16

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FEE STRUCTURE

Particulars	BSc (Data Science & Sports Studies)					
	First Year					
	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 (Data Science & Sports Studies)					
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**

Particulars	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
BSc (Data Science & Sports Studies)						
Third Year						
Fee Category						
ID Card	25	25	25	25	25	25
Admission Form / ApplicationForm 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**

Justification for introducing various new courses in the University ofMumbai

BSc (Data Science and Sports Studies)

1. Necessity of Starting the course

Considering the huge demand and supply gas 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, they said 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?
Not possible to further compress the course. The duration of 3 years is adequate to teach them nuances of data science and sports studies.

6. The intake capacity of each course and no. of admissions given in the current academic year (2021-22)
The proposed batch size in 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?
There is enough employment opportunity, post the completion of this course. - Post completion of the courses the students will have opportunities in industry as Machine leaching engineer, Data Science Engineer, Data Analyst, Sports Analyst.

Signature Chairman of BoS

Mr. Mohan Amrule