Programme: B.Sc. Honours Data Science (Major)

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	3+2	4
		2	Advances in Mathematical, Physical and Chemical Sciences	3+2	4
	II	3	Introduction to Data Science and R Programming	3	3
			Introduction to Data Science and R Programming Practical Course	2	1
		4	Descriptive Statistics	3	3
			Descriptive Statistics Practical Course	2	1
II	III	5	Python Programming for Data Analysis	3	3
			Python Programming for Data Analysis Practical Course	2	1
		6	Inferential and applied statistics	3	3
			Inferential and applied statistics Practical Course	2	1
		7	Data mining techniques using R	3	3
			Data mining techniques using R Practical Course	2	1
		8	Web technologies	3	3
			Web technologies Practical Course	2	1
	IV	9	Data visualization using Tableau	3	3
			Data visualization using Tableau Practical Course	2	1
		10	Data visualization using python	3	3
			Data visualization using python Practical Course	2	1
		11	Introduction to SQL & Advanced Tableau	3	3
			Introduction to SQL & Advanced Tableau Practical Course	2	1
III	V	12	Supervised Machine Learning with Python	3	3
			Supervised Machine Learning with Python Practical Course	2	1

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Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
		13	Unsupervised Machine Learning with Python	3	3
			Unsupervised Machine Learning with Python Practical Course	2	1
		14 A	Web Scraping with Python	3	3
			Web Scraping with Python Practical Course	2	1
		OR			
		14 B	Predictive & Advanced Analytics using R	3	3
			Predictive & Advanced Analytics using R Practical Course	2	1
		15 A	Advanced Data Analysis Using Python	3	3
			Advanced Data Analysis Using Python Practical Course	2	1
		OR			
		15 B	Data Wrangling with Java Script	3	3
			Data Wrangling with Java Script Practical Course	2	1
	VI	Semester Internship/Apprenticeship with 12 Credits			
IV	VII	16 A	Big Data Analytics Using Spark & Hadoop	3	3
			Big Data Analytics Using Spark & Hadoop Practical Course	2	1
		OR			
		16 B	Big Data security	3	3
			Big Data security Practical Course	2	1
		17 A	Introduction to Deep Learning	3	3
			Introduction to Deep Learning Practical Course	2	1
		OR			
		17 B	Deep Learning with Pytorch	3	3
			Deep Learning with Pytorch Practical Course	2	1
		18 A	AI Concepts and Techniques With Python	3	3
			AI Concepts and Techniques With Python Practical Course	2	1
		OR			
		18 B	Data and Information Security	3	3
			Data and Information Security Practical Course	2	1
		SEC			
		19	Introduction to Neural Networks	3	3
			Introduction to Neural Networks Practical Course	2	1
		20	Natural Language Processing	3	3
			Natural Language Processing Practical	2	1

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
			Course		
	VIII	21 A	Research Exploration	3	3
			Research Exploration Practical Course	2	1
		OR			
		21 B	Computational Data Science	3	3
			Computational Data Science Practical Course	2	1
		22 A	Computer Vision with Python	3	3
			Computer Vision with Python Practical Course	2	1
		OR			
		22 B	Data Wrangling with Java Script	3	3
			Data Wrangling with Java Script Practical Course	2	1
		23 A	Social Media Analytics	3	3
			Social Media Analytics Practical Course	2	1
		OR			
		23 B	Pyspark Essentials For Data Science	3	3
			Pyspark Essentials For Data Science Practical Course	2	1
		SEC			
		24	Business Intelligence and Visualization	3	3
			Business Intelligence and Visualization Practical Course	2	1
		25	Data Visualization using JavaScript	3	3
			Data Visualization using JavaScript Practical Course	2	1

SEMESTER-I
COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations

3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles **Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product andproblems **Statistical Measures**: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY:

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.

2. Elementary Trigonometry by H.S.Hall and S.R.Knight

3.Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.

4.Basic Statistics by B.L.Agarwal, New age international Publishers

5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman

6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.

8. Physics for Technology and Engineering" by John Bird

9. Chemistry in daily life by Kirpal Singh

10. Chemistry of bio molecules by S. P. Bhutan

11. Fundamentals of Computers by V. Raja Raman

12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors.

They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).
They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.
Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.
Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.
Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.
2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.
They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.
Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.
4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.
Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments
Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of

2. your college network) and prepare a report covering network architecture.

3. Identify the types of malwares and required firewalls to provide security.

4. Latest Fraud techniques used by hackers**.**

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Course – I & II Model Paper Time:3Hrs (70 Marks)

SECTION A (Multiple Choice Questions) ***30 x 1 = 30 M***

30 Multiple Choice Questions (Each Unit 6 Questions)

SECTION B (Fill in the blanks) ***10 x 1 = 10 M***

10 Fill in the Blanks (Each Unit 2 Questions)

SECTION C (Very short answer questions) ***10 x 1 = 10 M***

10 Very short answer questions (Each Unit 2 Questions)

SECTION D (Matching) (From 5 Units) ***2 x 5 = 10 M***

1 A
B
C
D
E

2 A
B
C
D
E

SECTION E (True or False) ***10 x 1 = 10 M***

10 True or False (Each Unit 2 Questions)

Single Major (w.e.f. AY 2023-24)
SEMESTER-I
COURSE – 1 ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL & CHEMICAL SCIENCES

Time:3hrs *MAX MARKS: 70 M*

I Multiple Choice Questions 3x10=30M

1. If Arg(Z) < 0 the Arg (-Z) – arg (Z) = [ ]
   a) π b) $\frac{\pi}{4}$ c) $\frac{-\pi}{2}$ d) $\frac{\pi}{2}$
2. If $\left|\frac{Z_1}{Z_2}\right| = 1$ and Arg $(Z_1 Z_2) = 0$ then [ ]
   a) $Z_1 = Z_2$ b) $|Z_1|^2 = Z_1 Z_2$ c) $Z_1 Z_2 = 1$ d) None of these
3. The value of $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$ is equal to [ ]
   a) 1 b) 0 c) ½ d) 2
4. If $\bar{a} + m\bar{b} + 3\bar{c}$, $-2\bar{a} + 3\bar{b} - 5\bar{c}$ and $\bar{a} - 3\bar{b} - 5\bar{c}$ are coplanar m=_____[ ]
   a) 2 b) -1 c) 1 d) -9/7
5. If the vectors $2\bar{i} + \lambda\,\bar{j} - \bar{k}$ and $4\bar{i} - 2\,\bar{j} + 2\bar{k}$ are perpendicular to each other, then
   λ = _____ [ ]
   a) 2 b) 5 c) 3 d) 1
6. Find the mode for the following data 0,0,1,1,2,2,2,4,5. [ ]
   a) 1 b) 0 c) 4 d) 2
7. Newton – Second is the unit of [ ]
   a) Velocity b) Angular Momentum c) Momentum d) Energy
8. If the force applied to a body is doubled and the mass is cut in half. What would be the acceleration ratio? [ ]
   a) 1:2 b) 2:1 c) 1:4 d) 4:1
9. Which unit is used to measure angle the S.I system? [ ]
   a) Radian b) Steradian c) Degree d) Minute
10. The mass – Energy relation is given by [ ]
    a) $E = mc^2$ b) F = ma c) P = mv d) W = Fd
11. How many types of Robots are there [ ]
    a) 7 b) 10 c) 6 d) 8
12. Light energy emitted by stars is due to [ ]
    a) Breaking of nuclei b) Joining of nucles
    c) Burning of nuclei d) Reflection of Solar Light
13. Organic chemistry is the study of_____. [ ]
    a) Nitrogen based compoundsb) Carbon based compounds
    c) Copper based compounds d) Chromium based compounds
14. Number of electrons present in outer shell of chlorine atom is____[ ]
    a) 5 b) 6 c) 7 d) 8
15. Which of the following is a disacchanide_____ [ ]
    a) Sucrose b) Glucose c) Fructose d) Ribose
16. The Monomers present in proteins are_____ [ ]
    a) Alcohols b) Acids c) Amino acids d) Esters
17. Lipids composed mainly of_____ [ ]
    a) C, H, N b) C, H, O c) O, N, S d) N, S, Cl

18. Vitamin by is also known as_____ [ ]
a) Vitamin – H b) Vitamin – O c) Vitamin – Bd) Vitamin – L
19. Who is introduced in Calculus_____. [ ]
a) Isaac Newton b) Goff fried Leibniz
c) Both of the mentioned d) None of the mentioned
20. How many systems does a robot have_____. [ ]
a) 2 b) 6 c) 4 d) 3
21. A place where power information (or) a result leaves a system. [ ]
a) Chassis b) Output c) Sensor d) Input
22. The main electronic component used in first generation computers was [ ]
a) Transistors b) Vacuum Tubes and Valves
c) Integrated Circuits d) None of above
23. Magnetic disk is an example of [ ]
a) Secondary memory b) Primary memory
c) Main memory d) Both 1 & 2
24. http stands for [ ]
a) hypertext transfer protocol b) hypertext transmission protocol
c) high transfer transport protocol d) hyper transfer text protocol
25. What is the full form of WWW? [ ]
a) World Wide Web b) World with Web
c) Work Wide Web d) World Wide Wet
26. Which one of the following is a type of antivirus program? [ ]
a) Quick heal b) Mcafee
c) Kaspersky d) All of the above
27. Hackers usually used the computer virus for_____purpose. [ ]
a) To log, monitor each and every user's stroke
b) To gain access the sensitive information like user's Id and Passwords
c) To corrupt the user's data stored in the computer system
d) All of the above
28. Which of the following is an example of f BDD screening technique [ ]
a) U V spectroscopy b) HPLC c) NMR spectroscopy d) None
29. Fertilizers mainly consists of_____ [ ]
a) N, P, K b) O, N, Cl c) C, O, K d) H, P, O
30. The substance that facilitate chemical reactions without being consumed is [ ]
a) Reactions b) Product c) Catalyst d) Inhibin

SECTION – B

II Fill in the Blanks 10x1=10M

1. Find the value of $\sqrt{3}\cos ec20^{\circ} - \sec 20^{\circ}$ is_____.
2. The area of the parallelogram whose diagonals are $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 3\hat{j} + 4\hat{k}$ is_____.
3. _____is the number of cycles made by a sounding body per unit time.
4. A light year is a unit of_____.
5. EXPAND SAR_____.
6. Peptide bond formula_____.
7. A robot is a_____.
8. Differential equations that_____the definition of linear are nonlinear.
9. A string of 8 bits is _____
10. ROM stands for _____

SECTION – C

III Answer the following Short Questions **10x1=10M**

1. If 3 tan A = 5 then Find Sin A and Cos A.
2. Find A.M from the following distribution.

Wages	100	120	140	160	180	200
No of workers	4	8	12	7	6	3

3. Write any two applications of Semi – Conductor?
4. Define Zeroth law of Thermodynamics? with example.
5. Expand FBDD.
6. What are fat soluble vitamins?
7. Define Newton's 1st Law.
8. Write any two application of Environmental monitoring?
9. What is E-mail?
10. What is a gateway?

SECTION – D

III Match the following **10x1=10M**

1. A. Unit Vector in the direction $\bar{a} = 3\bar{i} - 2\bar{j} + 6\bar{k}$ ( ) a) Angular Momentum
   B. Polar form $-1 + \sqrt{3}i$ ( ) b) Glucose
   C. Joule x Sec ( ) c) $\frac{1}{7}\left(3\bar{i} - 2\bar{j} + 6\bar{k}\right)$
   D. Mass of a proton ( ) d) $2\left[\cos\left(\frac{2\pi}{3}\right) + i\sin\left(\frac{2\pi}{3}\right)\right]$
   E. Reducing Sugar ( ) e) 1.676×10^{-24} grams

2. A. Vitamin – B12 ( ) a) Newton
   B. Force ( ) b) Newton second
   C. Impulse ( ) c) RBC formation
   D. Punch Card ( ) d) Computer games
   E. Joy Stick ( ) e) Hollerith code

SECTION – E

IV True (or) False **10x1=10M**

1. If Z is a complex number then $Z\bar{Z}$ is purely real.
2. If Z is a complex number such that $Z^2 = \left(\bar{Z}\right)^2$ then purely real.
3. The Mass of a body is equivalent to the ratio of the force action on it to the acceleration it generates.
4. The region of the atmosphere above troposphere is known as Lithosphere.
5. Essential Amino acids can be synthesized by the human body
6. Electrons fill the lowest energy levels first
7. For every action is nature here is an unequal and opposite reaction.
8. The special theory of relativity is concerned with frames of reference that are not experiencing any acceleration.
9. A terabyte is equal to 1 million gigabytes
10. Remote browser access is used to avoid browser-based hacking.

SEMESTER-I
COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICALAND CHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.

3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite).

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. **Recent advances in the field of nanotechnology**: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analyzing rates of change or optimizing functions.

3: Integration Exploration

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field. They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.

2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memorymaterials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.
Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.
Students will perform their experiments or simulations, collect data, analyze the results,and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants oneco systems and human health.
Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.
For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.
3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of

chemical pollutants on ecosystems.
Students will develop a detailed project plan, conduct experiments or simulations,analyze data, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.
Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.
They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.
Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.
Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics,medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.
Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

Students must be able to convert numbers from other number system to binary number systems

1. Identify the networking media used for your college network
2. Identify all the networking devices used in your college premises.

ADIKAVI NANNAYA UNIVERSITY: RAJMAHENDRAVARAM
Single Major B.Sc. Data Science (w.e.f:2023-24A.B)

Course – I & II Model Paper Time: 3Hrs (70 Marks)

SECTION A (Multiple Choice Questions) ***30 x 1 = 30 M***

30 Multiple Choice Questions (Each Unit 6 Questions)

SECTION B (Fill in the blanks) ***10 x 1 = 10 M***

10 Fill in the Blanks (Each Unit 2 Questions)

SECTION C (Very short answer questions) ***10 x 1 = 10 M***

10 Very short answer questions (Each Unit 2 Questions)

SECTION D (Matching) (From 5 Units) ***2 x 5 = 10 M***

1 A
B
C
D
E

2 A
B
C
D
E

SECTION E (True or False) ***10 x 1 = 10 M***

10 True or False (Each Unit 2 Questions)

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Single Major (w.e.f. AY 2023-24)
SEMESTER-I
Model Paper
COURSE -2 ADVANCES OF MATHEMATICAL, PHYSICAL & CHEMICAL SCIENCES
Time: 3Hrs ***MAX MARKS: 70 M***

I Multiple Choice Questions **3x10=30M**

SECTION – A

1. The equation of the line passing through the point (1, 2) and perpendicular to the line x+y+1=0 is [ ]
   a) y-x+1=0 b) y-x-1=0 c) y-x+2=0 d) y-x-2=0
2. $\lim_{x \to 0} \frac{1-\cos 2x}{x^2}$ is equal to [ ]
   a) 0 b) 1 c) 2 d) 4
3. The derivative of $\cos^{-1}(2x^2-1)$ w.r.to $\cos^{-1}(x)$ is [ ]
   a) 2 b) $\frac{-1}{2\sqrt{1-x^2}}$ c) $\frac{2}{x}$ d) 1- x^2
4. $\int e^{\tan x} \sec^2 x \, dx$ = [ ]
   a) $e^{\tan x}$ b) $e^{\sin x}$ c) $\tan x$ d) sin x
5. If $2x+y=\begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$ and $2x-y=\begin{bmatrix} 3 & 4 \\ -1 & 2 \end{bmatrix}$ then X is equal to [ ]
   a) $\begin{bmatrix} 4 & 4 \\ -4 & 4 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$ c) $\begin{bmatrix} -1 & -2 \\ -1 & 0 \end{bmatrix}$ d) None of these
6. If $A=[aij]_{mxn}$ such that aij = 0 for $i \neq j$ then A is [ ]
   a) a row matrix b) a column matrix
   c) a diagonal matrix d) a scalar matrix
7. Which of the following is an renewable energy source [ ]
   a) Coal b) Natural gas c) Solar d) Nuclear
8. What is the main purpose of Photovoltaic cells in solar panels [ ]
   a) Heat generation b) Electricity generation c) Water purification d) Carbon captune
9. Which renewable energy source is harnessed from the earth's Internal heat? [ ]
   a) Solar b) Wind c) Geothermal d) Hydro
10. What is the fundamental principle behind quantum mechanics [ ]
    a) Classical Mechanics b) Quantum Superposition c) Newton law of motion d) Maxwell's equation
11. What is the primary application of proton therapy in medical physics? [ ]
    a) Diagnostic Imaging b) Radiation therapy c) Magnetic resonance Imaging
    d) Computed Tomography (C.T)
12. What is the primary advantage of using quantum dob in solar cells? [ ]
    a) Low cost b) High efficiency
    c) Fast charging d) Large size
13. The Binding capacity between the drug and target is known as [ ]
    a) Virtual Screening b) Docking Score c) ADMET d) None
14. The Increased sensitivity of Nanosensors is due to [ ]
    a) High Surface-to-volume ratio b) Low surface-to-volume ratio
15. The green pigment chlorophyll is affected by [ ]
    a) Co_2 b) No_2 c) So_2 d) CH_4

16. What is the Photo catalyst used in the dye renoval catalysis method [ ]

a) Oxygen b) Hydrogen c) Titanium Oxide d) Zinc

17. Which phase of Shape memory alloy occurs at higher temperature & has a needle – like structure [ ]

a) Martensite b) Austenite c) Hysterisis d) None

18. The Pollutant causing Global warming [ ]

a) Co_2 b) So_2 c) No_2 d) O_3

19. In Quantum mechanics, the Schrodinger Equation is a fundamental Equation, used to model the behavior of particles. What does the Schrodinger Equation describe [ ]

a) Stability b) Wave-Particle duality
c) Degidity d) Massive

20. What is the term used to describe the process of using nano particles to enhance imaging techniques for medical diagnostics [ ]

a) Nano Scopy b) Nano Therapy c) Nano Diagnose d) None of these

21. How can nano medicine contribute to personalized medicine? [ ]

a) By increasing the cost of medical treatment.
b) By using a one-size –fits all approach.
c) By tailoring based on an individual's genetic make-up.
d) By avoiding the use of advanced technologies.

22. In radiation therapy, What does the term "brancy therapy" refer to [ ]

a) External beam radiation therapy
b) Radiation therapy using photons
c) Internal radiation therapy involving the placement of radio active sources directly within or close to the tumor.
d) Radiation therapy without the use of imaging.

23. What is the purpose of coagulation in the water treatment process? [ ]

a) Removing dissolved minerals
b) Disinteching water
c) Settling suspended particals
d) Adjusting PH levels

24. What is the purpose of green building design and construction? [ ]

a) maximizing energy consumption
b) minimizing the use of sustainable materials
c) Reducing the environmental impact of buildings
d) Ignoring energy – efficient technologies

25. Hybrid system combine which two types of signals? [ ]

a) Analog and Analog b) Digital and Digital c) Analog and Digital d) Continuous and Finite

26. Which error detection technique can detect a wide range of errors including burst errors and most multiple bits.

a) Hamming code b) Read- Solomon code c) Parity check d) CRC

27. Which layer of the OSI model does a router operate at [ ]

a) Transport layer b) Network layer c) Transport layer d) Data link layer

28. What technology allows DSL modems to separate voice and data signals.

a) Dail-up modem b) DSL modem c) Wireless modem d) Cable modem

Ans b) DSL modem

29. What protocol do bridges use to prevent network loops? [ ]

a) Internet Protocol b) Transmission Control Protocol (TCP)
c) Simple Network Management Protocol (SNMP) d) Spanning Tree Protocol (STP)

30. The……. between two words is the number of difference between corresponding bits

a) Hamming code b) Hamming distance [ ]
c) Hamming rule d) Hamming data

SECTION – B

III Fill in the Blanks **10x1=10M**

1. Tidal energy is an Example for_____energy.
2. _____are the particles used in quantum dots.
3. Expand CADD _____
4. First step in the purification of water _____
5. _____is an application for Medical Physics.
6. MRI stands for _____
7. $\int e^x \sin x \cos x dx =$_____.
8. Equation of the lines through the point (3, 2) and making an angle of 45° with the line x-2y = 3 are _____.
9. A computer understands only .....code
10. converts audio and video into digital information

SECTION – C

III Answer the following Questions **10x1=10M**

1. Give some Examples for renewable sources?
2. Information stored in quantum computer in the form of?
3. What is the difference between MRI and C.T. Scan?
4. Name two applications of Nanotechnology?
5. Solid waste Management? (SWM)
6. Expand ADMET
7. $\lim_{x \to 0} \frac{ax + x\cos x}{b\sin x}$; Evaluate
8. Evaluate $\int x(\log x)^2 dx$
9. What are the key design issues of the computer networks?
10. What is multiplexing?

SECTION – D

III Match the following **10x1=10M**

1. A. Wind energy ( ) a) Orthodontic applications
   B. Solar energy ( ) b) Non invasile imaging
   C. Minamata ( ) c) Harness the kinetic energy of wind to produce electricity
   D. Ni-Ti wire ( ) d) Convert sunlight into electricity
   E. Magnetic Resonance Imaging ( ) e) Mercury
2. A. Fluoroscene microscopy ( ) a) 3
   B. $\begin{bmatrix} 3 & -4 \\ m & 5 \end{bmatrix} = 3$ then m value is ( ) b) Moniterity cellular
   C. $\frac{d}{dx}[\log(\sec x + \tan x)]$ ( ) c) F1
   D. 1111000l ( ) d) Guided media
   E. Ethernet cable ( ) e) (secx)

SECTION – E

IV True (or) False **10x1=10M**

1. Quantum dots are the nano particles, are primarily used for structural Reintor cement in medical implants?
2. Quantum mechanics is a branch of physics Extensively used mathematical Models, to describe the behavior of particles at atomic and subatomic level.
3. The Mass of a body is equivalent to the ratio of the force action on it to the acceleration it generates.
4. The region of the atmosphere above troposphere is known as Lithosphere.
5. Essential Amino acids can be synthesized by the human body
6. Electrons fill the lowest energy levels first
7. The equation of a line with slope m and making an intercept c on y axis is y=mx
8. Intercept form of a line which cuts a and b respectively on the x and y axis

   Then $\frac{x}{a}+\frac{y}{b}=1$
9. A university would use a CAN to converts its composes in two cities.
10. Gateway device is operate at transport layer.

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SEMESTER-II

COURSE 3: INTRODUCTION TO DATA SCIENCE AND R PROGRAMMING

Theory Credits: 3 3 hrs/week

Aim and objectives of Course :

Data Science is a fast-growing interdisciplinary field, focusing on the analysis of data to extract knowledge and insight. This course will introduce students to the collection. Preparation, analysis, modelling and visualization of data, covering both conceptual and practical issues. Examples and case studies from diverse fields will be presented, and hands- on use of statistical and data manipulation software will be included.

Learning outcomes of Course:

- Recognize the various discipline that contribute to a successful data science effort.
- Understand the processes of data science identifying the problem to be solved, data collection,preparation, modeling, evaluation and visualization.
- Be aware of the challenges that arise in Data Sciences.
- Be able to identify the application of the type of algorithm based on the type of the problem.
- Be comfortable using commercial and open source tools such as the R/Python language and its associated libraries for data analytics and Visualization.

UNIT I:
Defining Data Science and Big data, Benefits and Uses, facets of Data, Data Science Process. History and Overview of R, Getting Started with R, R Nuts and Bolts

UNIT II:
The Data Science Process: Overview of the Data Science Process-Setting the research goal, Retrieving Data, Data Preparation, Exploration, Modeling, data Presentation and Automation. Getting Data in and out of R, Using reader package, Interfaces to the outside world.

UNIT III:
Machine Learning: Understanding why data scientists use machine learning-What is machine learning and why we should care about, Applications of machine learning in data science, Where itis used in data science, The modeling process, Types of Machine Learning-Supervised and Unsupervised.

UNIT IV:
Handling large Data on a Single Computer: The problems we face when handling large data, General Techniques for handling large volumes of data, Generating programming tips for dealing with large datasets.

UNIT V:

Sub setting R objects, Vectorised Operations, Managing Data Frames with the dplyr, Control structures, functions, Scoping rules of R, Coding Standards in R, Loop Functions, Debugging, Simulation. Case studies on preliminary data analysis.

TEXT BOOKS:

1. DavyCielen, Arno.D.B.Maysman, Mohamed Ali, "Introducing Data Science"ManningPublications, 2016.
2. Roger D. Peng, "R Programming for Data Science" Lean Publishing, 2015.

REFERENCE BOOKS:

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, AbhijitDasgupta, "PracticalData Science Cookbook", Packt Publishing Ltd., 2014.

WebReferences for case studies:

1. https://www.kaggle.com/datasets
2. https://github.com/

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SEMESTER-II

COURSE 3: INTRODUCTION TO DATA SCIENCE AND R PROGRAMMING

Practical | Credits: 1 | 2 hrs/week

Lab/Practical/Experiments/Tutorials syllabus:

1. Installing R and R studio, with proper notes on version management, cosmetic settings and different libraries.
2. Basic operations in r with arithmetic and statistics.
3. Getting data into R, Basic data manipulation, Loading Data into R
4. Basic plotting
5. Loops and functions
6. Create Vectors, Lists, Arrays, Matrices, Data frames and operations on them.
7. Demonstrate the visualization and graphics using visualization packages like ggplot2.
8. Implement Loop functions with lapply(), sapply(), tapply(), apply(), mapply().
9. Explore data using Single Variables: Unimodal, Bimodal, Histograms, Density Plots,Barcharts
10. Explore data using two Variables: Line plots, Scatter Plots, smoothing cures, Bar charts
11. Explore and implement commands using dplyr package
12. Download a dataset and work on basic data manipulation followed by inferential statistics.

RECOMMENDED TEXT BOOKS:

1. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley &Sons, Inc., 2012.
2. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.

Recommended Reference books:

3. The art of R Programming: A tour of Statistical Software design. Norman Matloff.KindleEdition
4. The book of R : The first course in Programming and Statistics by Tilman M. Davies.

Recommended Co-curricular activities: (Co-curricular Activities should not promote copyingfromtext book or from others' work and shall encourage self/independent and grouplearning)

A. Measurable:
1. Assignments on:
2. Student seminars (Individual presentation of papers) on topics relating to:
3. Quiz Programmes on:
4. Individual Field Studies/projects:
5. Group discussion on:
6. Group/Team Projects on:

B. General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics coveredin syllabus
2. Group Discussions on:
3. Watching TV discussions and preparing summary points recording personal observations etc.,under guidance from the Lecturers
4. Anysimilar activities with imaginative thinking.
5. Recommended Continuous Assessment methods:

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SEMESTER-II

COURSE 4: DESCRIPTIVE STATISTICS

Theory Credits: 3 3 hrs/week

Course Learning Outcomes: Students will acquire:

- knowledge of Statistics and its implementation through practical understanding for various domains related to data science.
- knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency and dispersion etc.
- knowledge of other types of data reflecting quality characteristics including concepts of independence and association between two attributes,
- insights into preliminary exploration of different types of data.
- Knowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations.

UNIT I:

Introduction to Statistics: Importance of Statistics. Scope of Statistics in different fields. Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Pie. Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean. Median and Mode through graph.

UNIT II:

Measures of Dispersion: Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance. Central and Non-Central moments and their interrelationship. Skewness and kurtosis.

UNIT III:

Curve fitting: Bi- variate data, Principle of least squares, fitting of degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, Fitting of power curve and exponential curves.

Correlation: Meaning, Types of Correlation, Measures of Correlation: Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Bi-variate frequency distribution, correlation coefficient for bi-variate data and simple problems. Concept of multiple and partial correlation coefficients (three variables only) and properties

UNIT IV:

Regression: Concept of Regression, Linear Regression: Regression lines, Regressioncoefficients and it's properties, Regressions lines for bi-variate data and simple problems. Correlation vs regression, sigmoid curve, derivation from linear regression to logistic regression.

UNIT-V

Attributes : Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data,Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency**,** Mean square contingency, Coefficient of mean square contingency,

TEXT BOOKS:

1. V.K.Kapoor and S.C.Gupta: Fundamentals of Mathematical Statistics,Sultan Chand &Sons, NewDelhi.
2. BA/BSc I year statistics - descriptive statistics, probability distribution - Telugu Academy - DrM.Jaganmohan Rao,Dr N.Srinivasa Rao, Dr P.Tirupathi Rao, Smt.D.Vijayalakshmi.
3. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI

REFERENCE BOOKS:

1. Willam Feller: Introduction to Probability theoryand its applications. Volume –I,Wiley
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, the World Press Pvt.Ltd.,Kolakota.
3. Hoel P.G: Introduction to mathematical statistics, Asia Publishinghouse.
4. M. JaganMohan Rao and Papa Rao: A Text book of StatisticsPaper-I.
5. Sanjay Arora and Bansi Lal: New Mathematical Statistics: Satya Prakashan , NewDelhi

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SEMESTER-II

COURSE 4: DESCRIPTIVE STATISTICS

Practical Credits: 1 2 hrs/week

List of the experiments:

1. Graphical presentation of data (Histogram, frequency polygon).
2. Diagrammatic presentation of data (Bar and Pie).
3. Computation of measures of central tendency (Mean, Median and Mode)
4. Computation of measures of dispersion (Q.D, M.D andS.D)
5. Computation of non-central, central moments, 1 and 2 for ungrouped data.
6. Computation of Karl Pearson's coefficients of Skewness and Bowley's coefficients of Skewness.
7. Fitting of straight line by the method of leastsquares
8. Fitting of parabola by the method of leastsquares
9. Fitting of power curve of the type bythe method of leastsquares.
10. Fitting of exponential curve of the type and by the method of leastsquares.
11. Computation of correlation coefficient and regression lines for ungrouped dat.
12. Computation of correlation coefficient, forming regression lines for grouped data

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Single Major B.Sc. Data Science (w.e.f:2023-24A.B)

Single Major
Model Question Paper
SEMESTER-II
B.Sc. Data Science
Introduction to Data Science and R Programming

Time:3hrs *MAX MARKS: 70 M*

SECTION – A

Answer any 5 questions. Each question carries 4 marks (5 X 4 = 20M)

1. What are the uses of data science and big data in r programming?
2. What is meant by data presentation and automation?
3. Write few applications of machine learning in data science?
4. What are the Generating programming tips for dealing with large datasets?
5. Write a short note on loop functions?
6. Write about Control structures, functions, Scoping rules of R?
7. What are the problems we face when handling large data?
8. What is meant reader package? write it uses?

SECTION – B

Answer all the questions. Each question carries 10 marks. (5 X 10 = 50M)

9.a) Explain briefly about Data Science Process?

(OR)

b) Write about history and Overview of R?

10. a) Explain about Data Science Process?

(OR)

b) Write an essay on getting Data in and out of R, Using reader package?

11. a) What is machine learning? Explain it's types?

(OR)

b) What are the uses of machine learning in data science and write it's applications?

12. a) What are the techniques used to handle the large amount of data on a single computer?

(OR)

b) Generating programming tips for dealing with large datasets.?

13. Write about coding Standards in R, Loop Functions, Debugging, Simulation?

(OR)

Explain briefly about Vectorised Operations?

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Single Major
Model Question Paper
SEMESTER-II
B.Sc. Data Science
Descriptive Statistics

Time:3hrs *MAX MARKS: 70 M*

SECTION – A

Answer any 5 questions. Each question carries 4 marks (5 X 4 = 20M)

1. What is the scope of Statistics in different fields?
2. Skewness and kurtosis of measures of depression?
3. What is meant by fitting of power curve and exponential curve?
4. Difference between correlation and regression?
5. Relationship between association and colligation of attributes?
6. Central and Non-Central moments and their interrelationship?
7. Explain about correlation coefficient for bi-variate data and simple problems?
8. Write about the Association of attributes and its measures?

SECTION – B

Answer all the questions. Each question carries 10 marks. (5 X 10 = 50M)

9. a)Write about Concepts of primary and secondary data?
(OR)
b)What is meant by measures of tendency ? Explain it's types ?

10. a)Define Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance?
(OR)
b) Explain about Central and Non-Central moments and their interrelationship?

11. a)What are the principles of least squares?
(OR)
b) Explain about fitting of degree polynomial and fitting of straight line?

12. a) Write about Regression lines, Regression coefficients and it's property?
(OR)
b) Write a derivation from linear regression to logistic regression?

13. a) Write an essay on relationship between association and colligation of attributes?
(OR)
b) Explain about Square contingency, Mean square contingency, Coefficient of mean square contingency?

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SEMESTER-III

COURSE 5: PYTHON PROGRAMMING FOR DATA ANALYSIS

Theory Credits: 3 3 hrs/week

Aim and objectives of Course:

- To be able to Program in Python
- To know and understand the data Analysis phases
- To know the usage of all libraries

Learning outcomes of Course:

- Understands and learn all basic concepts of
- Python Program Data Analysis methods in Python
- Get used with Python Programming environments

UNIT I:

What is Data Analysis? Differences between Data Analysis and Analytics, What is Python, Why Python for Data Analysis? What is Library, Essential Python Libraries. Python Language basics, I Python and Jupyter Notebook. Python Language Basics.

UNIT II:

Built-in Data Structures, Functions, Files and Operating System. **NumPy Basics:** Arrays and Vectorized Computation, The Numpy ndarray, Universal Functions, Array-Oriented Programming with Arrays, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number Generation.

UNIT III:

Getting Started with Pandas: Introduction to Pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics

Data Loading, Storage and File Formats: Reading and Writing Data in TextFormat, Binary Data Formats, Interacting with Web APIs, Interacting with Databases.

UNIT IV:

Data Cleaning and Preparation: Handling Missing Data, Data Transformation,String Manipulation.

Data Wrangling: Join, Combine and Reshape: Hierarchical Indexing, Combiningand Merging Datasets, Reshaping and Pivoting.

UNIT V:

Introduction to Modeling Libraries in Python: Interfacing between pandas andModel code, Creating model descriptions with Patsy, Introduction to stats models.

Plotting and Visualization: A brief matplotlib API Primer, Plotting with Pandas and Seaborn, Other Python visualization tools.

TEXT BOOKS:

1. Wes McKinney “Python for Data Analysis” O’reilly Publications Second edition
2. Charles R Suverance “Python for Everybody” Exploring data using Python 3

REFERENCE BOOKS:

1. John Zelle Michael Smith Python Programming, second edition 2010

Co-curricular Activities

Take up any application which involves the python coding. Example Case studies/Simulators: (https://knightlab.northwestern.edu/2014/06/05/five-mini-programming-projects-for-the-python-beginner/)

- Dice Rolling Simulator
- Guess the number
- Text based adventure game
- Hangman

Continuous assessment:

Let the students be tested in the following questions from each unit

1. What is Data Analysis. List out the differences between data analysis and dataanalytics
2. What is Python? Explain Python basics
3. Explain NumPy Basics
4. What is Data Loading. Explain Pandas Data Structures
5. What is Data Cleaning. Explain different phases in it
6. Explain Plotting and Visualization in Python

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SEMESTER-III

COURSE 5: PYTHON PROGRAMMING FOR DATA ANALYSIS

Practical | Credits: 1 | 2 hrs/week

1. Use matplotlib and plot an inline in Jupyter.
2. Implement commands of Python Language basics
3. Create Tuples, Lists and illustrate slicing conventions.
4. Create built-in sequence functions.
5. Clean the elements and transform them by using List, Set and DictComprehensions.
6. Create a functional pattern to modify the strings in a high level.
7. Write a Python Program to cast a string to a floating-point number but fails with Value Error on improper inputs using Errors and Exception handling.
8. Create an n array object and use operations on it.
9. Use arithmetic operations on Numpy Arrays
10. Using Numpy array perform Indexing and Slicing Boolean Indexing,FancyIndexing operations
11. Create an image plot from a two-dimensional array of function values.
12. Implement some basic array statistical methods (sum, mean, std, var, min,max, argmin, argmax, cumsum andcumprod) and sorting with sortmethod.
13. Implement numpy.random functions.
14. Plot the first 100 values on the values obtained from random walks.
15. Create a data frame using pandas and retrieve the rows and columns in itbyperforming some indexing options and transpose it.
16. Implement the methods of descriptive and summary statistics
17. Load and write the data from and to different file formats including WebAPIs.
18. Implement the data Cleaning and Filtering methods(Use NAhandlingmethods, fillna function arguments)
19. Transform the data using function or mapping
20. Rearrange the data using unstack method of hierarchical Indexing
21. Implement the methods that summarize the statistics by levels.
22. Use different Join types with how argument and merge data with keys andmultiple keys.

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SEMESTER-III

COURSE 6: INFERENTIAL AND APPLIED STATISTICS

Theory Credits: 3 3 hrs/week

Course Learning Outcomes
After completion of this course, the students will know about

- Concept of law large numbers and their uses
- knowledge about important inferential aspects such as point estimation, test ofhypotheses and associated concepts,
- knowledge about inferences from Binomial, Poisson and Normal distributions as illustrations,
- concept about non-parametric method and some important non-parametric tests.

- Time series data, its applications to various fields and components of time series,
- Various data collection methods enabling to have a better insight in policy making, planning and systematic implementation, Construction and implementation of life tables, Population growth curves, population estimates and projections,
- Real data implementation of various demographic concepts as outlined above through practical assignments.

UNIT I:
Concepts: Population, Sample, Parameter, statistic, Sampling distribution, Standard error. convergence in probability and convergence in distribution, law of large numbers, central limit theorem (statements only).Student's t- distribution, F – Distribution, χ^2-Distribution: Definitions, properties and their applications.

UNIT II:
Theory of estimation and Hypothesis: Estimation of a parameter, criteria of a good estimator – unbiasedness, consistency, efficiency, &sufficiency and. Binomial, Poisson &Normal Population parameters estimate by MLE method. Confidence Intervals. Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. Examples in case ofBinomial, Poisson and Normal distributions.

UNIT III:
Sample tests: t-test for single mean, difference of means and paired t- test.□2. confidence intervalsfor mean(s). standard deviation(s) and correlation coefficient(s).Test for goodness of fit andindependence of attributes. F-test for equality of variances.
Non-parametric tests- their advantages and disadvantages, comparison with parametric tests. Measurementscale- nominal, ordinal, interval and ratio.

UNIT IV:
Time Series: Time Series and its components with illustrations, additive, multiplicative models. Trends:Estimation of trend by free hand curve method, method of semi averages. Determination of trend by least squares (Linear trend, parabolic trend only), moving averages method.

UNIT V:

Vital Statistics: Introduction, definition and uses of vital statistics, sources of vital statistics. measures ofdifferent Mortality and Fertility rates, Measurement of population growth. Life tables: construction and uses of life tables.

TEXT BOOKS:

1. BA/BSc II year statistics - statistical methods and inference - Telugu Academy by A.Mohanrao,N.Srinivasa Rao, Dr R.Sudhakar Reddy, Dr T.C. RavichandraKumar.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC.PHI.
3. Fundamentals of applied statistics : VK Kapoor and SCGupta.
4. BA/BSc III year paper - III Statistics - applied statistics - Telugu academy by prof.K.SrinivasaRao,Dr D.Giri. Dr A.Anand, Dr V.PapaiahSastry.

REFERENCE BOOKS:

1. Brockwell, P.J. and Devis, R.A. (2003). Introduction to Time Series Analysis. Springer.
2. Chatfield, C. (2001). Time Series Forecasting., Chapman & Hall.
3. Srinivasan, K. (1998). Demographic Techniques and Applications. Sage Publications
4. Srivastava O.S. (1983). A Text Book of Demography. Vikas Publishing House
5. Fundamentals of Mathematics statistics : VK Kapoor and SCGuptha.
6. Outlines of statistics, Vol II : Goon Guptha, M.K.Guptha, Das GupthaB.
7. Introduction to Mathematical Statistics : HoelP.G.
8. Hogg Tanis Rao: Probabilityand Statistical Inference. 7th edition.Pearson.

CO-CURRICULAR ACTIVITIES:

- Quiz Competition
- Expert Lectures
- Seminars

EXTRA CURRICULAR ACTIVITIES:

- Formal Examination
- Lab Practical
- Presentation
- Simple Projects

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SEMESTER-III

COURSE 6: INFERENTIAL AND APPLIED STATISTICS

Theory Credits: 3 3 hrs/week

List of Experiments:

1. Large sample test for difference of means.
2. Large sample test for single proportion
3. Large sample test for difference of proportions , standard deviations , correlation coefficient.
4. Small sample test for single mean, difference of means and correlation coefficient
5. Paired t-test(pairedsamples).
6. Small sample test for single variance(χ 2 - test)

Time Series:

7. Measurement of trend by method of moving averages(odd and evenperiod)
8. Measurement of trend by method of Least squares(linear andparabola)
9. Determination of seasonal indices by method simpleaverages
10. Determination of seasonal indices by method of Ratio to movingaverages

Vital Statistics:

11. Computation of various Mortalityrates
12. Computation of various Fertilityrates
13. Computation of various Reproductionrates.
14. Construction of Life Tables

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SEMESTER-III

COURSE 7: DATA MINING TECHNIQUES USING R

Theory Credits: 3 3 hrs/week

Aim and objectives of Course:

- To understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.

Learning outcomes of Course:

Students who complete this course will be able to

- Compare various conceptions of data mining as evidenced in both research andapplication.
- Evaluate mathematical methods underlying the effective application of data mining.
- Should be able to apply the type of techniques based on the problems considered.
- Can find out the market patterns and association amongst different products.

UNIT I:

An idea on Data Warehouse, Data mining-KDD versus data mining, Stages of the Data MiningProcess-Task primitives., Data Mining Techniques – Data mining knowledge representation.

UNIT II

Data mining query languages- Integration of Data Mining System with a Data Warehouse-Issues, Data pre-processing – Data Cleaning, Data transformation – Feature selection – Dimensionality reduction

UNIT III

Concept Description: Characterization and comparison What is Concept Description,Data Generalization by Attribute-Oriented Induction(AOI), AOI for Data Characterization, Efficient Implementation of AOI.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts, FrequentItemset Mining Methods: Apriori method, generating Association Rules, Improvingthe Efficiency of Apriori,Pattern-Growth Approach for mining Frequent Item sets.

UNIT-IV

Classification Basic Concepts: Basic Concepts, Decision Tree Induction: Decision TreeInduction Algorithm, Attribute Selection Measures, Tree Pruning. Bayes Classification Methods.

UNIT-V

Association rule mining: Antecedent, consequent , muti-relational association rules,

ECLAT.Case study on Market Basket Analysis.

Cluster Analysis: Cluster Analysis, Partitioning Methods, Hierarchal methods, Density basedmethods-DBSCAN.

TEXT BOOKS:

1. Jiawei Han, MichelineKamber, Jian Pei."Data Mining: Concepts and Techniques", 3rd Edition,Morgan Kaufmann Publishers, 2011.
2. AdelchiAzzalini, Bruno Scapa, "Data Analysis and Data mining" , 2ndEdiiton, Oxford Univeristy Press Inc., 2012.
3. Data Mining, The Textbook (2015) by Charu Aggarwal.

REFERENCES BOOKS:

1. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", 10th Edition, TataMcGraw Hill Edition , 2007.
2. G.K. Gupta, "Introduction to Data Mining with Case Studies", 1st Edition, EasterEconomy Edition, PHI, 2006.

Student Activities:

1. Students should be able to implement Data Mining algorithms provided the relevantdata
2. Given the data, students can visualize all statistical measures
3. Differentiate the types of mining problems and identify what type of algorithms are tobe implemented.

Continuous assessment:

Let the students be tested in the following questions from each unit

1. What is Data Mining and KDD? Where Data Mining fits in KDD Process
2. Describe all Preprocessing methods
3. Explain Data Description and AOI Algorithm
4. Explain Classification and Write any Decision tree induction algorithm
5. Explain the concept of clustering and write any algorithm to form clusters.

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SEMESTER-III

COURSE 7: DATA MINING TECHNIQUES USING R

Practical | Credits: 1 | 3 hrs/week

1. Get and Clean data using dplyr exercises.
2. Visualize all Statistical measures(Mean ,Mode, Median, Range, InterQuartile Range etc.,using Histograms, Boxplots and Scatter Plots).
3. Create a data frame with atleast 10 entries of columns EMPID,EMPNAME,SALARY,STARTDATE

   a. Extract two column names using column name.
   b. Extract the first two rows and then all columns.
   c. Extract 3^{rd} and 5^{th} row with 2^{nd} and 4^{th} column.

4. Create a data frame with 10 observations and 3 variables and add new rows andcolumns to itusing ‘rbind’ and ‘cbind’ function.
5. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of any dataset to create a new data frame. ‘discrete’ with Categorical variables and the class label.
6. Create a simple scatter plot using any dataset using ‘dplyr’ library. Use the samedata to indicate distribution densities using box whiskers.
7. Write R Programs to implement k-means clustering, k-medoids clustering anddensity based clustering on any datasets.
8. Write a R Program to implement decision trees using ‘reading Skills’ dataset.
9. Implement decision trees using any dataset using package partyand ‘rpart’.
10. Generate top 5 association rules using apriori.
11. Generate top 5 association rules using ECLAT.
12. Write an R program to implement Naïve bayes Classification.

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SEMESTER-III

COURSE 8: WEB TECHNOLOGIES

Theory | Credits: 3 | 3 hrs/week

COURSE OBJECTIVES: This subject enables the student to create flexible, attractive, user-friendlyweb sites comprised of both static and dynamic web pages.. Along with that students will also learn about interactions with web pages through JavaScript and host own web site on internet.

LEARNING OUTCOMES: After Studying this subject students would have capability to make theirown web site and host on internet. Also students would have enough knowledge about the technologies used in internet.

UNIT I : HTML: Basic HTML Tags and Attributes, Document body, Text, Hyper links, Adding moreFormatting, Lists, Tables, Grouping, Images. More HTML: Multimedia Objects, Frames, Forms, Headers.

UNIT II : Cascading Style Sheets: Introduction, Syntax, Selectors, Background Cursors, Text Fonts,Lists, Tables, Box Model, Using Styles, Simple Examples, Creation of Own Styles, Properties And Values In Styles, Formatting Blocks of Information, Layers.

UNIT III : Introduction to JavaScript: What is DHTML, JavaScript Basics, Variables, String Manipulations, Mathematical Functions, Statements, Operators, Arrays and Functions.

UNIT IV : DHTML with JavaScript: Data Validation, Opening A New Window, Messages andConfirmations, Status Bar, Different Frames, Rollover Buttons, Moving Images.

UNIT V : XML: Defining Data for Web Applications, Basic XML, Document Type Definition,Presenting XML, Document Object Model, Web Services.

TEXT BOOKS: 1. Harvey M. Deitel and Paul J. Deitel, “Internet & World Wide Web How to Program”, 4/e, Pearson Education. 2. Uttam Kumar Roy,WebTechnologies from Oxford UniversityPress Student Activities.

Co-curricular Activities:

- We for Web – Students with right mix of skills are formed as groups to develop websites.
- Web Ninja- A platform to showcase creative websites developed by students to their peers.

Assessment Methods:

- Formal Examinations .
- Lab Practical Examination .
- Presentations .
- Simple Project.

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SEMESTER-III

COURSE 8: WEB TECHNOLOGIES

Practical | Credits: 1 | 2 hrs/week

1. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
2. Create your class timetable using table tag.
3. Create a feedback form for your curriculum. Use textbox, text area, checkbox, radio buttonetc
4. Create a web page using frame. Divide the page into two parts with Navigation links on lefthand side of page (width=20%) and content page on right hand side of page (width = 80%). Onclicking the navigation Links corresponding content must be shown on the right hand side.
5. Write html code to develop a webpage having two frames that divide the webpage into two equal rows and then divide the row into equal columns fill each frame with a different background colour.
6. Create your resume using HTML tags. Experiment with colours, text, link, size and also other tags you studied.
7. Design a web page of your College Day Celebrations with an attractive background colour,text colour, images, font etc. Use CSS.
8. Use Inline CSS to format your resume that you created.
9. Use External CSS to format your class timetable as you created.
10. Use External, Internal, and Inline CSS to format web page of your start up.
11. Develop a JavaScript to display your admission details in the college.
12. Develop simple calculator for addition, subtraction, multiplication and division operationusing JavaScript.
13. Create HTML page with JavaScript which takes integer number as input and tells whetherthe number is odd or even.
14. Create HTML page that contains form for registration of your participation in a hackathon.Use relevant fields for input data. Write a JavaScript code to combine and display the input information when the button is clicked.
15. Create a login form with id and password. Perform input validation

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SEMESTER-IV
COURSE 9: DATA VISUALIZATION

Theory Credits: 3 3 hrs/week

Aim and objectives of Course:

- To know the importance of data Visualization in the world of DataAnalytics and Prediction
- To know the important libraries in Tableau
- To get equipped with Tableau Tool

Learning outcomes of Course:

- Students should be able to visualize data through seven stages of data analysisprocess
- Should be able to do explanatory and hybrid types of data visualization
- Should be able to understand various stages of visualizing data

UNIT I:

Creating Visual Analytics with tableau desktop, connecting to your data-How to Connect to your data, What are generated Values? Knowing when to use a direct connection, Joining tables with tableau, blending different data sources in a single worksheet.

UNIT II:

Building your first Visualization- How Me works- Chart types, Text Tables, Maps, bar chart, Line charts, Area Fill charts and Pie charts, scatter plot, Bullet graph, Gantt charts, Sorting data in tableau, Enhancing Views with filters, sets groups and hierarchies.

UNIT III:

Creating calculations to enhance your data- What is aggregation, what arecalculated values and table calculations, Using the calculation dialog box to create,Building formulas using table calculations, Using table calculation functions **UNIT IV:**

Using maps to improve insights-Create a Standard Map View, Plotting your ownlocations on a map, Replace Tableau's standard maps, Shaping data to enable Point-to-Point mapping.

UNIT V:

Developing an Adhoc analysis environment- generating new data with forecasts, providing self evidence adhoc analysis with parameters, Editing views in tableau Server.

TEXT BOOKS:

1. Tableau your data-Daniel G. Murray and the Inter works BI team, Wiley Publications
2. Tableau Data Visualizaton Cookbook, AshutoshNandeshwar, PACKT publishing.
3. Storytelling with Data: A Data Visualization Guide for BusinessProfessionals by Cole NussbaumerKnaflic (2014)
4. ggplot2: Elegant Graphics for Data Analysis by Hadley Wickham (2009)

REFERENCE BOOKS:

1. Designing Data Visualizations: Representing Informational Relationshipsby Noah Iliinsky, Julie Steele (2011)
2. Alexandru C. Telea – "Data Visualization principles and practice" SecondEdition, CRC Publications
3. Joshua N. Millign–" Learning Tableau -2019" – Third Edition- Packt publications

Student Activity

Create a sample super store data set and visualize the following requirements

General Requirements

1. Dashboard size is 1250px wide by 750px tall.
2. Prefer using containers
3. The dashboard has a total of 5 containers (no more, no less)
4. The Filter Pane
5. Each filter has some padding

1. Charts Pane Requirement

1. All 3 charts must be in one vertical container
2. Do proper formatting
3. Each chart has some padding between them and other objects
4. Each chart has a grey border, slightly darker than the Pane background color.
5. The Pane under the Title has a border

2. The second graph should have the title as "Sales" and should showmonthly sales per year. Make sure it is an area chart with proper formatting.

3. The third graph should the title as "Profit" and should show monthlyprofit per year. Make sure it is an area chart with proper formatting.

Continuous assessment:
Let the students be tested in the following questions from each unit

1. What are generated values? Join tables using Tableau
2. Create any visualization charts using Chart types, Text Tables, Maps, barchart, Line charts, Area Fill charts and Pie charts, scatter plot etc.,
3. What is aggregation, what are calculated values and table calculations?
4. Using Standard Map View, Plot your own locations on a map
5. Develop an Adhoc analysis environment.

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SEMESTER-IV

COURSE 9: DATA VISUALIZATION

Practical Credits: 1 2 hrs/week

1. Connect to data Sources
2. Create Univariate Charts
3. Create Bivariate and Multivariate charts
4. Create Maps
5. Calculate user-defined fields
6. Create a workbook data extract
7. Save a workbook on a Tableau server and web
8. Export images, data.

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SEMESTER-IV

COURSE 10: DATA VISUALIZATION USING PYTHON

Theory Credits: 3 3 hrs/week

Course Objective :

This course introduces students to data analysis and visualization inthe field of exploratory data science using Python.

Course Learning Outcomes : On successful completion of thecourse, the students will be able to

1. Use data analysis tools in the pandas library.
2. Load, clean, transform, merge and reshape data.
3. Create informative visualization and summarize data sets.
4. Analyze and manipulate time series data.
5. Solve real world data analysis problems.

Unit 1

Introduction: Introduction to Data Science, Exploratory Data Analysisand Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python Jupyter Notebook. Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels, seaborn.

Unit 2

Getting Started with Pandas: Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics. Data Loading, Storage and File Formats. Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs,

Interacting with Databases Data Cleaning and Preparation. HandlingMissing Data, Data Transformation, String ManipulationUnit 3

Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting. Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other pythonvisualization tools. Advanced categorical and numeric plots.

Unit 4

Data Aggregation and Group operations: Group by Mechanics, Dataaggregation, General split-apply-combine, Pivot tables and cross tabulation

Time Series Data Analysis: Date and Time Data Types and Tools,Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions.

Unit 5 Advanced Pandas:

Categorical Data: cleaning data and visualization techniques, Advanced GroupBy methods ,Use Techniques for Method Chaining.**Textbook:**

1. McKinney, W.(2017). Python for Data Analysis: Data Wranglingwith Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.

Reference:

1. O'Neil, C., & Schutt, R. (2013). Doing Data Science: Straight Talkfrom the Frontline O'Reilly Media.

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SEMESTER-IV

COURSE 10: DATA VISUALIZATION USING PYTHON

Practical Credits: 1 2 hrs/week

1. Practicals based on NumPy ndarray
2. Practicals based on Pandas Data Structures
3. Practicals based on Data Loading, Storage and File Formats
4. Practicals based on Interacting with Web APIs
5. Practicals based on Data Cleaning and Preparation
6. Practicals based on Data Wrangling
7. Practicals based on Data Visualization using matplotlib
8. Practicals based on Data Aggregation
9. Practicals based on Time Series Data Analysis

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SEMESTER-IV

COURSE 11: INTRODUCTION TO SQL & ADVANCED TABLEAU

Theory | Credits: 3 | 3 hrs/week

Learning Objectives:

- ✓ Design a database using DBMS softwares.
- ✓ Perform SQL queries on database.
- ✓ Use Tableau's visualization tools to conduct data analysis,especially exploration of an unfamiliar dataset.

Course Outcomes:

- ✓ Design a database by their own and perform simple and adhocqueries.
- ✓ Employ best practices in data visualization to develop charts, maps,tables, and other visual representations of data.
- ✓ Employ best practices in data visualization to develop charts, maps,tables, and other visual representations of data.
- ✓ Create compelling, interactive dashboards to combine severalvisualizations into a cohesive and functional whole.
- ✓ Utilize advanced Tableau features including parameters, datablending, custom SQL, very
- ✓ large data

UNIT I:

Overview of Database Management System: Introduction to data,information, database, database management system , DBMS software's,

, keys in DBMS. the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree,relationship classification, reducing ER diagram to tables,

UNIT 2:

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, Data Types in SQL, Data Definition Language, DataManipulation Language, database constraints, Aggregate functions, Join Operation, Set Operations, Views. SQL queries, sub queries and corelated queries,

Unit 3 : Optimal visualization types – bar chart, pie chart, gantt chart, bubble chart, bullet chart, scatter plot, line chart, heat map, tree map Maps- geographical locational plotting, Binning values , Calculated fields , Tablecalculations , Level of Detail calculations.

Unit 4 : Dashboard development, Dashboard design principles, dashboard interactivity, Connected "drill-down" dashboardsBest Practices, Creating visualizations with Tableau.

Unit 5 : Advanced Tableau, Large datasets, Fiscal Year Calculations , Parameters, tableau scripting, tableau server, integration of tableau with Rprogramming.

Textbooks:

1. Show me the Numbers: Designing Tables and Graphs toEnlighten by Stephen Few
2. The Data Loom: Weaving Understanding by ThinkingCritically and Scientifically with Data by Stephen Few

Reference Books:

1. The Big Book of Dashboards: Visualizing your Data using Real-World Business Scenarios by Steve Wexler, Jeffrey Shaffer, andAndy Cotgreave

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SEMESTER-IV

COURSE 11: INTRODUCTION TO SQL & ADVANCED TABLEAU

Practical Credits: 1 2 hrs/week

DATABASE MANAGEMENT SYSTEM LAB

Consider following databases convert entities and relationships torelation table for a given scenario.

1. **COLLEGE DATABASE:**

   STUDENT (stno, SName, Address, Phone, Gender)course(courseid, Sem, Sec)

   CLASS (stno, courseid)

   SUBJECT (Subcode, Title, Sem, Credits)

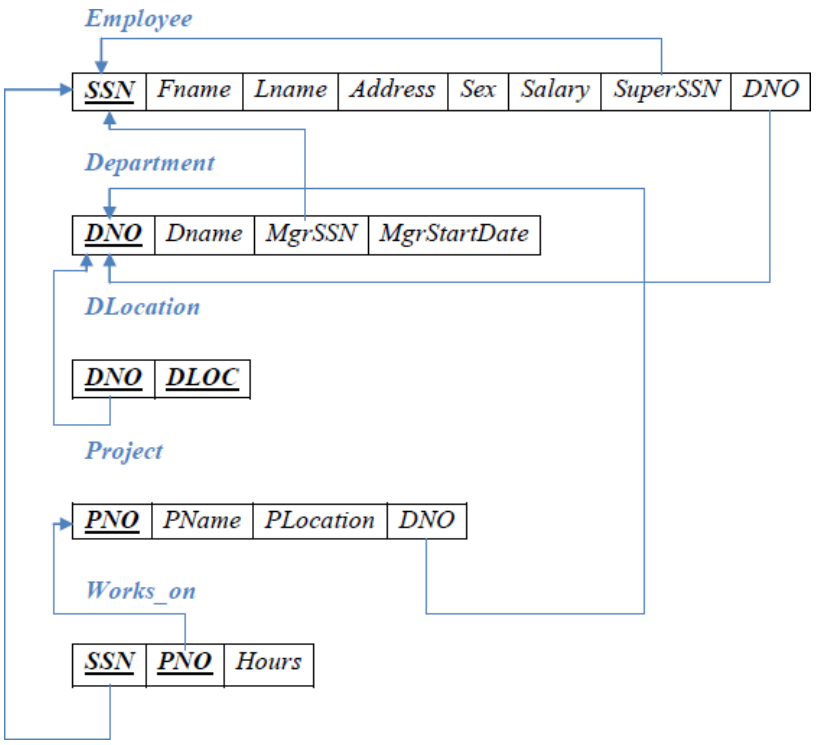
   MARKS (stno, Subcode, courseid, Test1, Test2, Test3, total)

2. **COMPANY DATABASE:**

   EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo,DLoc)

   PROJECT (PNo, PName, PLocation, DNo)WORKS_ON (SSN, PNo, Hours)

3. **Consider a college database schema**



a. Create above tables with relevant Primary Key, Foreign Key and otherconstraints

b. Populate the tables with data

4. Perform queries to generate outputs:

1. Display all the details of all employees working in the company.
2. Display ssn, lname, fname, address of employees who work indepartment no 7.
3. Retrieve the Birthdate and Address of the employee whose name is'Franklin T.Wong'
4. Retrieve the name and salary of every employee.
5. Retrieve all distinct salary values
6. Retrieve all employee names whose address is in ‘Bellaire’
7. Retrieve all employees who were born during the 1950s
8. Retrieve all employees in department 5 whose salary is between50,000 and60,000 (inclusive)

5. Perform the following queries

1. Retrieve the names of all employees who do not have supervisors2.Retrieve SSN and department name for all employees

3. Retrieve the name and address of all employees who work for the 'Research'department

4. For every project located in 'Stafford', list the project number, thecontrolling department number, and the department manager's last name, address, and birth date.

5. For each employee, retrieve the employee's name, and the name of hisor her immediate supervisor.

6. Retrieve all combinations of Employee Name and Department Name7.Make a list of all project numbers for projects that involve an

employee whose last name is 'Narayan' either as a worker or as amanager of the department that controls the project.

8.Increase the salary of all employees working on the 'ProductX' projectby 15%. Retrieve

employee name and increased salary of these employees. 9.Retrieve a list of employees and the project name each works in,ordered by the employee's

department, and within each department ordered alphabetically byemployee first name.

10.Select the names of employees whose salary does not match withsalary of any employee in

department.

6. Perform following queries :

1. Retrieve the employee numbers of all employees who workon project located in Bellaire, Houston, or Stafford.

2. Find the sum of the salaries of all employees, the maximumsalary, the minimum salary, and

the average salary. Display with proper headings

3. Find the sum of the salaries and number of employees of allemployees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salaryin this department.

4. Select the names of employees whose salary is greater thanthe average salary of all employees in department 10.

5. Delete all dependents of employee whose ssn is'123456789'.

6. Perform a query using alter command to drop/add field and aconstraint in Employee table.

7. Format your data using filters with colors

8. create dashboards and stories.
9. Distribute and publish your visualization.
10. create advanced mapping –
    1. point-to-point map
    2. Dual axis map
11. Calculate distance between two points on a map.

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SEMESTER-V

COURSE 12: SUPERVISED ML WITH PYTHON

Theory Credits: 3 3 hrs/week

Aim and objectives of Course:

- The purpose of this course is to serve as an introduction to Supervisedmachine learning with Python.
- We will explore several classifications, regression algorithms and see howthey can help us perform a variety of Supervised machine learning tasks.

Learning outcomes of Course:

- Able to understand introduction to machine learning concepts.
- Able to Loading datasets, build models and model persistence.
- Understand Feature extraction from data sets.
- Able to do Regression & Classification.
- Able to compare SVM with other classifiers.

UNIT I:

Machine Learning Basics: What is machine learning? Key terminology, Key tasksof machine learning, How to choose right algorithm, steps in developing a machinelearning, why python? Getting started with Numpy library Classifying with k- Nearest Neighbors: The k-Nearest Neighbors classification algorithm, Parsing and importing data from a text file, Creating scatter plots with Matplotlib, Normalizingnumeric values

UNIT II:

Splitting datasets one feature at a time-Decision trees: Introducing decision trees, measuring consistency in a dataset, using recursion to construct a decision tree, plotting trees in Matplotlib

UNIT III:

Classifying with probability theory-Naïve Bayes: Using probability distributions for classification, learning the naïve Bayes classifier, Parsing data from RSS feeds, using naïve Bayes to reveal regional attitudes

UNIT IV:

Logistic regression: Classification with logistic regression and the sigmoidfunction, Using optimization to find the best regression coefficients, the gradientdescent optimization algorithm, Dealing with missing values in the our data **UNIT V:**

Support vector machines: Introducing support vector machines, using the SMO algorithm for optimization, using kernels to “transform” data, Comparing support vector machines with other classifiers

TEXT BOOK:

1. Machine learning in action, Peter Harrington by Manning publications

Supervised ML with Python Lab

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SEMESTER-V

COURSE 12: SUPERVISED ML WITH PYTHON

Practical | Credits: 1 | 2 hrs/week

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a CSV file. For a given set of training data examples stored in a .CSV file, implement anddemonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file.
4. Assuming a set of documents that need to be classified, use the naïve BayesianClassifier model to perform this task. Built-in Java classes/API can be used towrite the program. Calculate the accuracy, precision, and recall for your dataset.

SEMESTER-V

COURSE 13: UNSUPERVISED ML WITH PYTHON

Theory Credits: 3 3 hrs/week

Aim and objectives of Course (Unsupervised ML with Python):

- Unsupervised Machine Learning involves finding patterns in datasets.
- The core of this course involves study of Clustering, feature extractionand optimization algorithms.
- The purpose of this course is to serve as an introduction to machinelearning with Python.

Learning outcomes of Course:

- Able to do Clustering, feature extraction and optimization.
- Students will be able to understand and implement in Python algorithmsof Unsupervised
- Machine Learning and apply them to real-world datasets.

Syllabus: (Total Hours: 90 including Teaching, Lab andinternal exams, etc.)

UNIT I:

Unsupervised Learning: Clustering: k-means clustering algorithm, Improving cluster performance with post processing, Bisecting k-means, Example:clustering points on a map

UNIT II:
Association analysis : Apriori algorithm: Association analysis, The Apriori principle, Finding frequent item sets with the Apriori algorithm, Mining association rules from frequent item sets, uncovering patterns in congressional voting

UNIT III:
Finding frequent item sets: FP-growth –FP trees, Build FP-tree, mining frequent from an FP-tree, finding co-occurring words in a Twitter feed, mining a click stream from a news site.

UNIT IV:
Principal component analysis: Dimensionality reduction techniques, using PCA to reduce the dimensionality of semiconductor manufacturing data

UNIT V:
Singular value decomposition: Applications of the SVD, Matrix factorization, SVD in Python, Collaborative filtering–based recommendation engines, a restaurant dish recommendation engine

TEXT BOOK:
1. Machine learning in action, Peter Harrington by Manning publicationsUnsupervised ML with Python Lab

SEMESTER-V

COURSE 13: UNSUPERVISED ML WITH PYTHON

Practical | Credits: 1 | 2 hrs/week

Details of Lab/Practical/Experiments/Tutorials syllabus:

1. Implementation of K-Means Clustering
2. Implement the bisecting k-means clustering algorithm
3. Implement Apriori algorithm
4. Implement Association rule-generation functions
5. Implement FP-tree creation
6. Write a function to find all paths ending with a given item.
7. Implement Code to access the Twitter Python library
8. Implement the PCA algorithm
9. Write a program to find Rating estimation by using the SVD
10. Implement Image-compression functions using SVD.

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SEMESTER-V

COURSE 14 A: WEB SCRAPING WITH PYTHON

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

Students at the successful completion of the course will be able to:

1. Parse complicated HTML pages
2. Develop crawlers with the Scrapy framework
3. Learn methods to store data you scrape
4. Read and extract data from documents
5. Clean and normalize badly formatted data
6. Read and write natural languages
7. Crawl through forms and logins
8. Scrape JavaScript and crawl through APIs
9. Use and write image-to-text software
10. Avoid scraping traps and bot blockers
11. Use scrapers to test your website

Detailed Syllabus: (Five units with each unit having 12 hours of class work)UNIT-1

Building Scrapers: First Web Scraper: Connecting, An Introduction to BeautifulSoup, **Advanced HTML Parsing:** Another Serving of BeautifulSoup, Regular Expressions, Regular Expressions and BeautifulSoup, Accessing Attributes, Lambda Expressions, **Writing Web Crawlers:** Traversing a Single Domain, Crawling an Entire Site, Crawling Across the Internet.

UNIT-II

Web Crawling Models: Planning and Defining Objects, Dealing with Different Website Layouts, Structuring Crawlers. **Scrapy:** Installing Scrapy, Initializing a New Spider, Writing a Simple Scraper, Spidering with Rules, Creating Items, Outputting Items, The Item Pipeline, Logging with Scrapy. **Storing Data:** Media Files, Storing Data to CSV, MySQL: Integrating with Python, Database Techniques and Good Practice, Six Degrees in MySQL, Email

UNIT-III

Advanced Scraping:Reading Documents: Document Encoding, Text, CSV, PDF, Microsoft Word and .docx,**Reading and Writing Natural Languages:** Summarizing Data, Markov Models, Natural Language Toolkit. **Crawling Through Forms and Logins:** Python Requests Library, Submitting a Basic Form, Radio Buttons, Checkboxes, and Other Inputs, Submitting Files and Images, Handling Logins and Cookies.

UNIT-IV

Crawling Through APIs: A Brief Introduction to APIs, Parsing JSON, Undocumented APIs, Finding Undocumented APIs, Documenting Undocumented APIs, Finding and Documenting APIs Automatically.

Image Processing and Text Recognition: Overview of Libraries, Pillow, Processing Well-Formatted Text, Reading CAPTCHAs and Training Tesseract, Retrieving CAPTCHAs and Submitting Solutions

UNIT-V

Avoiding Scraping Traps: A Note on Ethics, Looking Like a Human, Common Form Security Features, The Human Checklist Testing Your Website with Scrapers: An Introduction to Testing, Python unit test, Testing with Selenium, unittest or Selenium. The Legalities and Ethics of Web Scraping: Trademarks, Copyrights, Patents, Trespass to Chattels, The ComputerFraud and Abuse Act, robots.txt and Terms of Service, Three Web Scrapers

Text Books:

1. "*Web Scraping with Python, by Ryan Mitchell*", 2nd Edition, O'Reilly Media, Inc.,2018.
2. "*Hands-On Web Scraping with Python*", by Anish Chapagain, Packt Publishing, 2019.

References:

1. "*Getting Structured Data from the Internet*", by Jay M. Patel, Apress, 2020
2. "*Python Web Scraping Cookbook*", by Michael Heydt, Packt Publishing, 2018.
3. "*Web Scraping with Python*, by Richard Lawson", Packt Publishing, 2015.

CO-CURRICULAR ACTIVITIES:

- Quiz Competition
- Expert Lectures
- Seminars

EXTRA CURRICULAR ACTIVITIES:

- Formal Examination
- Lab Practical
- Presentation
- Simple Projects

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SEMESTER-V

COURSE 14 A: WEB SCRAPING WITH PYTHON

Practical Credits: 1 2 hrs/week

1. Write a Python program to test if a given page is found or not on the server.

2.Write a Python program to download and display the content of robot.txt for wikipedia.org.

3. Write a Python program to get the number of datasets currently listed on data.gov.

4. Write a Python program to convert an address into geographic coordinates (like latitude andlongitude).

5. Write a Python program to display the name of the most recently added dataset on data.gov.

6. Write a Python program to extract h1 tag from example.com.

7. Write a Python program to extract and display all the header tags fromen.wikipedia.org/wiki/Main_Page.

8. Write a Python program to extract and display all the image links from a website.

9. Write a Python program to get 90 days of visits broken down by browser for all sites ondata.gov.

10 Write a Python program to that retrieves an arbitrary Wikipedia page of "Python" and creates a list of links on that page.

11. Write a Python program to check whether a page contains a title or not.

12. Write a Python program to list all language names and number of related articles in the order they appear in wikipedia.org.

13. Write a Python program to get the number of followers of a given twitter account.

14. Write a Python program to find the live weather report (temperature, wind speed, description and weather) of a given city.

15. Write a Python program to display the date, days, title, city, country of next 25 events.

16. Write a Python program to download IMDB's Top 250 data (movie name, Initial release, director name and stars).

17. Write a Python program to get movie name, year and a brief summary of the top 10 random movies.

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SEMESTER-V

COURSE 14 B: PREDICTIVE AND ADVANCED ANALYTICS USING R

Theory Credits: 3 3 hrs/week

Aim and objectives of Course (Predictive and Advanced Analytics):

The course enables students to:

- To learn, how to develop models to predict categorical and continuous outcomes, usingsuch techniques as neural networks, decision trees, logistic regression, support vectormachines and Bayesian network models.
- To know the use of the binary classifier and numeric predictor nodes to automate model selection.
- To advice on when and how to use each model. Also learn how to combine two or moremodels to improve prediction

Learning outcomes of Course (In consonance with the Bloom's Taxonomy):The students will be able to:

- Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business application.
- Compare the underlying predictive modeling techniques.
- Select appropriate predictive modeling approaches to identify cases to progress with.
- Apply predictive modeling approaches using a suitable package such as SPSSModeler

Unit-I

Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining, Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining on various kinds of data, Applications of Data Mining, Challenges of Data Mining.

Unit II: Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection

Unit III: Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.

Unit IV: Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values. Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID

Unit V: Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Deploying Model, Assessing Model Performance, Updating a Model.

Recommended Text Book:

1. Predictive & Advanced Analytics (IBM ICE Publication)
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag,2009.

Cocurricular Actvities:

- Quiz Competition
- Expert Lectures
- Seminars

Assessment Methods:

- Formal Examination
- Lab Practical
- Presentation
- Simple Projects

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SEMESTER-V

COURSE 14 B: PREDICTIVE AND ADVANCED ANALYTICS USING R

Practical Credits: 1 2 hrs/week

Predictive And Advanced Analytics Using R Lab

- Implementation of following methods using R or Matlab
- 1.Simple and multiple linear regression
- 2.Logistic regression
- 3. Linear discriminant analysis
- 4.Ridge regression
- 5. Cross-validation and boot strap
- 6. Fitting classification and regression trees
- 7. K-nearest neighbors
- 8. Principal component analysis
- 9.K-means clustering

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SEMESTER-V

COURSE 15 A: ADVANCED DATA ANALYSIS USING

Theory Credits: 3 3 hrs/week

Course outcomes:

This course will enable the student to:

- Present an overview data science and applications.
- Plan the methods of data collection.
- Describe the statistical methods in EDA.
- Apply statistical methods to develop and evaluate the models.
- Becoming an expert in decision making for complex projects.

UNIT I – INTRODUCTION

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

UNIT II – DATA COLLECTION AND PRE-PROCESSING

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT III – EXPLORATORY DATA ANALYTICS

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots –Pivot Table – Heat Map – Correlation Statistics – ANOVA.

UNIT IV – MODEL DEVELOPMENT

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation –
Prediction and Decision Making.

UNIT V – MODEL EVALUATION

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Text Books:

1. Jojo Moolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGIGlobal.

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SEMESTER-V

COURSE 15 A: ADVANCED DATA ANALYSIS USING

Practical | Credits: 1 | 2 hrs/week

1. Creating a Data Frame and Matrix-like Operations on a Data Frame,Merging two Data Frames
2. Applying functions to Data Frames, import of external data in variousfile formats, statistical functions, compilation of data.
3. Using Functions with Factors
4. Accessing the Internet
5. Visualization Effects
6. Plotting with Layers
7. Overriding Aesthetics
8. Histograms and Density Charts
9. Simple Linear Regression – Fitting, Evaluation and Visualization
10. Multiple Linear Regression, Lasso and Ridge Regression
11. Use the following scenarios:
12. Use the Diabetes data set from UCI and Pima Indians Diabetes data setfor performing the following:
    Univariate Analysis: Frequency, Mean, Median, Mode, Variance, StandardDeviation, Skewness and Kurtosis.

i. Bivariate Analysis: Linear and logistic regressionmodeling.
ii. Multiple Regression Analysis
iii. Also Compare the results of the above analysis for the twodata sets.
b. Data Modelling

i. Apply Bayesian and SVM techniques on Iris and Diabetesdata set.
ii. Apply and explore various plotting functions on UCI datasets.

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SEMESTER-V

COURSE 15 B: DATA WRANGLING WITH JAVA SCRIPT

Theory Credits: 3 3 hrs/week

UNIT I

Getting started: establishing your data pipeline - Why data wrangling-What's data wrangling -Why use JavaScript for data wrangling- Is JavaScript appropriate for data analysis? Navigating the JavaScript ecosystem - Establishing your data pipeline

UNIT II

Getting started with Node.js - Building a simple reporting system -Getting the code and data - Viewing the code - Installing Node.js - Running Node.js code -Running a web application - Getting the data - Checking your Node.js version -Working with Node.js Creating a Node.js project - Creating a command-line application - Creating a code library - Creating a simple web server - Asynchronous coding - Loading a single file - Loading multiple files - Error handling - Asynchronous coding with promises - Wrapping asynchronous operations.

UNIT III

Acquisition, storage, and retrieval -Getting the code and data -The core data representation- Loading data from text files - Loading data from a REST API-Parsing JSON text data- Parsing CSV text data- Importing data from databases - Importing data from MongoDB- Importing data from MySQL - Exporting data - Exporting data to text files - Exporting data to JSON text files -Exporting data to CSV text files- Exporting data to a database - Exporting data to MongoDB-Exporting data to MySQL.

UNIT IV

Exploratory coding - Iteration and your feedback loop - A first pass atunderstanding your data - Working with a reduced data sample - Prototyping with Excel - Exploratory coding with Node.js -Using Nodemon -Exploring your data - Using Data-Forge - Computing the trend column - Outputting a new CSV file - Exploratory coding in the browser .

UNIT 5

Clean and prepare - The need for data cleanup and preparation - Where does broken data come from? - How does data cleanup fit intothe pipeline- Identifying bad data - Techniques for fixing bad data - Cleaning our data set -Preparing our data for effective use.

TEXTBOOK

Data Wrangling with JavaScript - Ashley Davis - Manning Publication

REFERENCE TEXTBOOKS:

Principles of Data Wrangling - Practical Techniques for Data Preparation

- Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel,Connor Carreras - Oreilly Publication.

Data Wrangling with Python - Jacqueline Kazil, Katharine Jarmul 2016-Oreilly Publication.

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SEMESTER-V

COURSE 15 B: DATA WRANGLING WITH JAVA SCRIPT

Practical | Credits: 1 | 2 hrs/week

1. Installing steps for Node.js, Installing npm dependencies, printingversion of Node.js. Developing a Simple program to print “Hello World” on console.
2. Create a Code library to a command-line application in Node.jsto produce a report from data.
3. Install “Express Node.js framework” . Create a simple Webapplication to print your college name on Web Page.
4. Develop an Web application to add static files to web server.
5. Develop an application to import & export data using MongoDB.
6. Develop an application to import & export data using MYSQL.
7. Loading your input CSV file and printing its contents to the console. Apply slicing operation on data and print on Console.Print datatype of each column(attribute) of CSV file.
8. List column names and data types of column names of a CSV fileusing Data-Forge (An open source data-wrangling toolkit for JavaScript).
9. Develop a web visualization application by importing data fromExcel file.
10. Develop an application to do Excel data analysis in Node.js usingFormulajs.
11. Develop a program to clean your data by rewriting rows to fixbad data.

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SEMESTER-VII

COURSE 16 A: BIG DATA ANALYTICS USING SPARK & HADOOP

Theory Credits: 3 3 hrs/week

Aim and objectives of Course:

- To Understand the Complete Architecture of Spark
- To know the differences between Hadoop and Spark
- To know the concepts of Spark Programming

Learning outcomes of Course:

- Students will get well knowledge of what is
- Big DataKnowledge in Spark Eco System
- Mapping of Data Analytics techniques in Spark
- Application of Spark Programming to Analytics problems

UNIT I:

Introduction to Big Data: What is Big Data-Characteristics, Data in the Warehouse and Data in Hadoop, Why is Big Data Important- When to consider Big Data Solution, Applications. Introduction to Hadoop: Hadoop- definition, Application development in Hadoop. The building blocks of Hadoop, Name Node, Data Node, Secondary Name Node, Job Tracker and Task Tracker.

UNIT II:

Introduction to Spark: What is Apache Spark, Why Spark when Hadoop is there, Spark Features, , Spark components, Spark program flow, Spark Eco System. Differences between implementation of programs in Hadoop and Spark Programming environments.

UNIT III:

Spark Fundamentals- Using spark in action VM, Using Spark Shell and writing first sparkprogram, Basic RDD actions and transformations. Spark SQL-Working with Data Frames, Using SQL Commands, Saving and loading Data Frame.

UNIT IV:

Streaming in Spark- Writing spark streaming applications, Using external data sources, structured streaming. Spark MLlib-Introduction to Machine Learning. Definition of Machine Learning, Machine Learning with Spark.

UNIT V:

Graph Representation in MapReduce: Graph Processing with Spark, Spark GraphX, GraphX features, Graph Examples, Graph algorithms-Shortest Path Algorithm.

TEXT BOOKS:

1. Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data by Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, 1st Edition, TMH,2012.
2. Spark in Action PetarZecevic, markoBonaci Manning Publications-2016.
3. Learning Spark"Holden KarauA. Konwinskietc.,"O'reilly Publications

REFERENCE BOOKS:

1. Hadoop in Action by Chuck Lam, MANNING Publishers.
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Mining of massive datasets, AnandRajaraman, Jeffrey D Ullman, Wiley Publications.

Student Activities:

Take any dataset and do the following machine learning steps.(https://www.guru99.com/pyspark-tutorial.html)

1. Use basic Operations with PySpark(Spark with Python)
2. Data Pre-processing
3. Build a data processing pipeline
4. Build the classifier
5. Train and evaluate the model
6. Tune the hyper parameter

Continuous assessment:

1. Let the students be tested in the following questions from each unit
2. What is Big Data? Explain the characteristics of it
3. What is Spark? What are the advantages of it over Hadoop
4. Explain Spark SQL
5. Explain Spark Streaming
6. Explain Shortest Path Algorithm.

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SEMESTER-VII

COURSE 16 A: BIG DATA ANALYTICS USING SPARK & HADOOP

Practical Credits: 1 2 hrs/week

1. Using Python Implement the following Programs

a) Write Program to implement arithmetic operations

b) Write Program to find the biggest of two numbers

c) Write a program to find the matrix multiplication

2. Install Hadoop
3. Install Spark on top of Hadoop
4. Create and Implement the transformations in RDDs
5. Create a data frame from an existing RDD using Spark Session
6. Execute a Word Count example in Spark Shell by creating RDDs.
7. Implement Spark SQL Queries in Python.
8. Write a Program to implement maximum temperature give the recordings of oneyear.
9. Write a Program to implement the Pie estimation
10. Write a User Defined Function to convert a given text to Uppercase.

SEMESTER-VII

COURSE 16 B: BIG DATA SECURITY

Theory Credits: 3 3 hrs/week

Course Objective

With the data generated from electronic devices growing exponentially, the need to analysed data on a large scale is important. Such data are of many types like financial,personal etc. Big data environment also created significant security challenges. When trying to make quick decisions. Data breach poses many complications. This course aims at introducing concepts related to big data security.

Learning Outcomes :

1. Understanding significance of privacy, ethics in big data environment.
2. Analyzing the steps to secure big data.
3. Analyzing data security and event logging.

Unit-I

BIG DATA PRIVACY, ETHICS AND SECURITY: Privacy- Re identification of Anonymous people – Why Big Data Privacy is self regulating? – Ethics – Ownership –Ethical Guidelines - Big Data Security – Organizational Security.

Unit-II

SECUTIY, COMPLIANCE, AUDITING, AND PROTECTION: Steps to secure bigdata – Classifying Data – Protecting – Big Data Compliance – Intellectual Configuration..

Unit-III

HADOOP SECURITY DESIGN: Kerberos – Default Hadoop Model Withoutsecurity Hadoop Kerberos Security Implementation & Configuration.

Unit-IV

HADOOP ECOSYSTEM SECURITY: Configuring Kerberos for Hadoop ecosystem components – Pig. Hive. Oozie, Flume, HBase, Scoop.

Unit-V

HADOOP ECOSYSTEM SECURITY: Integrating Hadoop with Enterprise SecuritySystems-Securing Sensitive Data in Hadoop – SIEM System – Setting up audit logging in hadoop cluster.

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SEMESTER-VII

COURSE 16 B: BIG DATA SECURITY

Practical | Credits: 1 | 2 hrs/week

1. Learn the basics of Mongo DB.
2. Installation steps for Mongo DB.
3. Use the following commands

(a) DATABASE_NAME.
(b) Drop Database( )
(c) create Collection
(d) insert( )
(e) drop( )
(f) find( )

4. Differentiate between SQL and Mongo DB.
5. Write a program to update a collection in Mongo DB
6. Write a program to remove specific document from Mongo DB.
7. Write a program to implement aggregate function in Mongo DB
8. Apply the Map reduce operation to find total salary of each department assumingemployee collection is already exists.

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SEMESTER-VII

COURSE 17 A: INTRODUCTION TO DEEP LEARNING

Theory Credits: 3 3 hrs/week

Course Objectives:

1. To introduce basics of linear algebra and probability theory
2. To introduce the fundamental techniques and principles of Neural Networks
3. To familiarize different models in Artificial Neural Networks (ANN) and their applications
4. To familiarize deep learning concepts with Convolutional Neural Network case studies
5. To explain functioning of deep neural networks

Course Outcomes:

After learning the course, the students will be able to:

1. Discuss feed forward networks and their training issues
2. Distinguish different types of ANN architectures
3. Design Feed Forward Neural Network architecture for research problems
4. Apply mathematical concepts such as linear algebra, calculus to solve the research problems.
5. Apply deep learning techniques to practical problems
6. Evaluate model performance and interpret results

Unit 1

Linear Algebra and Probability Theory: Linear Algebra :Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices Calculus: Derivatives and Differentiation, Partial Derivatives, Gradients Probability Theory : Basic Probability Theory, Dealing with Multiple Random Variables, Expectation and Variance.

Unit 2

Fundamentals of Neural Networks: Introduction to Neural Network, Model of Artificial Neuron, Learning rules and various activation functions.

Unit 3

Neural Network Architecture: Single layer Feed-forward networks. Multi-layer Feed-forward networks. Recurrent Networks.

Unit 4

Back propagation Networks: Back Propagation networks, Architecture of Back-propagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation algorithms.

Unit 5

Deep Neural Networks: Introduction to Deep Neural Networks, training deep models, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, Gradient-Descent Strategies, vanishing and exploding Gradient problems, regularizations, dropouts.

Text Books:

1. S.Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and GeneticAlgorithms", PHI Learning Pvt. Ltd., 2003, ISBN:978-81-203-2186-1.

2. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", Amazon Science, 2021.

Reference Books:

1. Jacek M. Zurada,"Introduction to artificial neural systems", West Publishing Co., 1992, ISBN: 0-3 14-93391 -

2. Goodfellow I., BengioY., and Courville A., "Deep Learning", MIT Press, 2016, ISBN: 978-0262035613.

3. Bishop C. M., "Pattern Recognition and Machine Learning", Springer, 2006, ISBN: 978-0-387-31073-2.

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SEMESTER-VII

COURSE 17 A: INTRODUCTION TO DEEP LEARNING

Practical Credits: 1 2 hrs/week

1. Design and implement a CNN for Image Classification:

   a) Select a suitable image classification dataset (medical imaging, agricultural,etc.).

   b) Optimized with different hyper-parameters including learning rate, filter size,no. of layers, optimizers, dropouts, etc.

2. Apply a pre-trained network and apply it to a new task using transfer learning

   a) Use any three pre-trained models including AlexNet, GoogleNet, VGGNet,MobileNet, ResNet, DenseNet, etc.

   b) Fine-tune the hyper-parameters and compare their performance for a suitable application.

3. Design RNN or its variant including LSTM or GRU

   a) Select a suitable time series dataset. Example – predict sentiments based onproduct reviews

b) Apply for prediction

4. build a word2vec model for unstructured data a) Use any unstructured textdataset

b) Convert words into a representative vector of numerical values5.Implement an artificial neural network on GPUs

a) Implement ANN on GPUs.

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SEMESTER-VII

COURSE 17 B: DEEP LEARNING WITH PYTORCH

Theory Credits: 3 3 hrs/week

Aim and objectives of Course (Predictive and Advanced Analytics):

The course enables students to:

- To learn, PyTorch and relates PyTorch to deeplearning.
- To know about pretrained models to work with data sets
- To learn how to work with neural networks in deep learning.

Learning outcomes of Course (In consonance with the Bloom's Taxonomy):

The students will be able to:

- Learn about deep learning , PyTorch library and their applications.
- How to use Tensors in deep learning Tensor-API
- To work with time series in deep learning.
- To develop a PyTorch Neural Network model using "torch.nn" module.

UNIT I

Introducing deep learning and the PyTorch Library - The Deep Learning revolution -PyTorch for Deep Learning - Why Pytorch - An overview of how PyTorch supports deep learning projects - Hardware and Software requirements - Using Jupyter Notebooks.

UNIT II

Pretrained Networks - A pretorined that reconnizes the subject of an image - A pertained network that describes scenes - Starting with Tensor- Tensors.

UNIT III

Multidimensional arrays - Indexing tensors - Named Tensors - Tensor element types - The tensor API - Tensors: Scenic views of storage.

UNIT IV

Real workd data representation using tensors - Working with images - Representing tabular data - Working with time series - Representing text - The mechanics of Learning - Learning is just parame-ter estimation - Less loss is what we want .

UNIT V

Using a nearly network to fit the data - Artificial neutrons - The PyTorch nn module - Finally a neural network.

TEXTBOOK:

Deep Learning with PyTorch - Eli Stevens, Luca Antiga, Thomas Viehmann - Manning Publica-tions

REFERENCES:

1. Programming PyTorch for Deep Learning: Creating and Deploying Deep LearningApplica-tions by Ian Pointer - Oreilly Publications.

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SEMESTER-VII

COURSE 17 B: DEEP LEARNING WITH PYTORCH

Practical | Credits: 1 | 2 hrs/week

1. Build a Jupiter Notebook Server for Pytorch.
2. Program On CycleGAN network: Use CycleGAN network model to turn one imageinto another image. Feed the image of the golden retriever into the horse-to-zebra model. (Refer Prescribed Textbook)
3. Develop a program to convert integers into floating point numbers in pyTorch usingtensors.
4. Develop a program on multi-dimensional arrays using TensorFlow.
5. Develop a PyTorch program to perform different Tensor Indexing operations.
6. Develop a PyTorch program on “named tensors”.
7. Develop a program in TensorFlow for representing text. Define a function clean_words, which takes text as input and returns it in lowercase and print individual words in given text.
8. Perform timeseries operations on bikes data. Use following url for reference (code/p1ch4/4_time_series_bikes.ipynb)
9. Working with images: Take several pictures of red, blue, and green items with your phone or oth-er digital camera . Load each image, and convert it to a tensor. For each imagetensor, use the .mean() method to get a sense of how bright the image is.
10. Develop a PyTorch Neural Network model using “torch.nn” module.

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SEMESTER-VII

COURSE 18 A: AI CONCEPTS AND TECHNIQUES WITH PYTHON

Theory Credits: 3 3 hrs/week

Aim and objectives of Course :

- This course provides an introduction to the fundamentals of artificial intelligence.
- Demonstrates fundamental understanding of the history of artificial intelligence (AI)
- and its foundations.
- Apply basic principles of AI in solutions that require problem solving, inference,
- perception, knowledge representation, and learning.
- Demonstrates awareness and a fundamental understanding of various applications ofAI
- techniques in intelligent Agents.

Learning outcomes of Course:

- List the objectives and functions of modern Artificial Intelligence.
- Categorize an AI problem based on its characteristics and its constraints.
- Understand and implement search algorithms.
- Learn how to analyze the complexity of a given problem and come with suitable
- optimizations.
- Demonstrate practical experience by implementing and experimenting with the learnt
- Algorithms

UNIT I:

Problems and Search: What is Artificial Intelligence, The AI Problems, and Underlying Assumption, what is an AI Technique. Problems, Problems Spaces, and Search: Defining the problem as a state space search,production systems, problems characteristics, issues in the design of search programs.

UNIT II:

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis

UNIT III:

Knowledge Representation Issues: Representations and Mapping, Approaches to Knowledge Representation, The frame problem. Using Predicate Logic: Representing simple facts in logic, Representing Isa relationships, predicates, Resolution

UNIT IV:

Representing Knowledge using Rules: Procedural Vs Declarative knowledge, Logic Programming, Forward Vs Backward Reasoning, Matching, Control Knowledge

UNIT V:

Symbolic Reasoning under Uncertainty: Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation issues, Augmenting a Problem solver, implementation: DFS, BFS. Statistical Reasoning: Probability and Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory.

TEXT BOOK:

1. Artificial Intelligence, Second Edition, Elaine Rich, Kevin Knight, Tata McGraw-Hill Edition.

REFERENCES BOOK:

1. Russell, S., &Norvig, P. Artificial intelligence: a modern approach. Third Edition.Pearson new International edition. 2014

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SEMESTER-VII

COURSE 18 A: AI CONCEPTS AND TECHNIQUES WITH PYTHON

Practical Credits: 1 2 hrs/week

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman problem using Python.
7. Write a Program to Implement Towers of Hanoi problem using Python.
8. Write a Program to implement 8-Queens problem using Python.

SEMESTER-VII

COURSE 18 B: DATA & INFORMATION SECURITY

Theory Credits: 3 3 hrs/week

Overview of Security: Protection versus security; aspects of security – data integrity, data availability, privacy; security problems, user authentication, Orange Book.

Unit -II

Security Threats: Program threats, worms, viruses, Trojan horse, trap door, stack and buffer overflow; system threats- intrudes; communication threats- tapping and piracy.

Unit -III

Cryptography: Substitution, transposition ciphers, symmetric-key algorithms – Data Encryption Standard, advanced encryption standards, public key encryption – RSA; DiffieHellman key exchange, ECC cryptography, Message Authentication – MAC, has functions.

Unit -IV

Digital Signatures: Symmetric key signatures, public key signatures, message digests,public key infrastructures.

Unit -V

Security Mechanism: Intrusion detection, auditing and logging, tripwire, system –call monitoring.

Text Books:

1. W. Stallings, Cryptography and Network Security Principles and Practices (4th ed.,), Prentice – Hall of India, 2006.
2. C. Pfleeger and SL Pfleeger, Security in Computing (3rd ed.,), Prentice- Hall of India, 2007.

Reference Books:

1. D. Gollamann, Computer Security, John Wiley and Sons, Ny, 2002.
2. J. Piwprzyk, T. Hardjono and J. Seberry, Fundamentals of Computer Security,
3. Springer- Verlag Berling, 2003.
4. J.M. Kizza, Computer Netwrok Security, Springer, 2007
5. M. Merkow and J. Breithaupt, Information Security: Principles and Practices, Pearson
6. Education, 2006.

Student Activity

Case Study I: Transform Data from one format to another format using Cryptography.Case Study II: How mails are hacked.

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SEMESTER-VII

COURSE 18 B: DATA & INFORMATION SECURITY

Practical | Credits: 1 | 2 hrs/week

1. Implement Ceiser Cipher encryption in Python.
2. Implement Ceiser Cipher decryption in Python.
3. Implement Transposition technique encryption in Python.
4. Implement Substitution cipher encryption in Python.
5. Implement Substitution cipher decryption in Python.
6. Implement One time Pad cipher in Python.
7. Implement DES encryption in Python.
8. Implement RSA Public Key encryption in Python

SEMESTER-VII

COURSE 19: INTRODUCTION TO NEURAL NETWORKS

Theory Credits: 3 3 hrs/week

Learning Objectives:

1. The main objective of Neural Network Techniques to Improve Data Analysis Solutions is tostrengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.

2. Also introduce the neural networks for classification, regression and to give design methodologies for artificial neural networks.

Learning Outcome:

On successful completion of this course, student will be able to

1. Obtain the fundamentals and types of neural networks. The student will have a broad knowledge in developing the different algorithms for neural networks.
2. Analyze neural controllers
3. Have a broad knowledge in Fuzzy logic principles and will be able to determine different methods of Deffuzification

UNIT 1

Introduction to Artificial Intelligence System: Neural Network, Fuzzy logic, Genetic Algorithm. Fundamentals of Neural Networks: What is Neural Network, Model of Artificial Neuron, Learning rules and various activation functions.

Unit 2

Neural Network Architecture: Single layer Feed-forward networks. Multilayer Feed-forward networks. Recurrent Networks. Back propagation Networks: Back Propagation networks, Architecture of Back-propagation(BP) Networks, Back-propagation Learning, Variation of Standard Back propagation algorithms.

Unit 3

Introduction about Fuzzy set theory: Fuzzy versus Crisp, Crisp and fuzzy sets, Crisp and Fuzzy relations. Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy logic, Fuzzy rule based system, Defuzzification Methods, Applications.

Unit 4

Integration of Neural Network, Fuzzy logic and Genetic Algorithm: Hybrid system. Neural Networks, Fuzzy logic, and Genetic Algorithm Hybrids.

Unit 5

Associative Memory: Autocorrelators, Heterocorrelators, Wang et al's Multiple Training Encoding Strategy, Exponential BAM, Associative Memory for Real coded pattern pairs, Applications.

Text book:

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing HouseEd. 2006.
3. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003 Neuro-FuzzySystems, Chin Teng Lin, C. S. George Lee, PHI.
4. Build_Neural_Network_With_MS_Excel_sample by Joe choong.

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SEMESTER-VII

COURSE 19: INTRODUCTION TO NEURAL NETWORKS

Practical | Credits: 1 | 2 hrs/week

1. Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the finalweights.

2 Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.

3 Train the autocorrelator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, -1,1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).

4. To Implement Convolution Neural network for Text classification or Image Classification

5. Implementation of Naïve Bayes/SVM/SGD/SVM classifier on text and image

6. To study Word Embedding techniques : Word2vec,doc2vec,Glove

7. Implement Linear/Logistic regression

SEMESTER-VII

COURSE 20: NATURAL LANGUAGE PROCESSING

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The basic objectives of natural language processing course are the following:

1. Learn the basics of natural language processing and understand variousstеps in it.
2. To introduce the fundamentals of language processing from thealgorithmic viewpoint.
3. To discuss various issues that make natural language processing a hardtask.
4. To discuss some well-known applications of natural language processing

LEARNING OUTCOME:

At the end of the course, the student should be able to:

1. Appreciate the fundamental concepts of natural language processing.
2. Design algorithms for natural language processing tasks.
3. Develop useful systems for language processing and related tasksinvolving text processing.

UNIT I :

INTRODUCTION :Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics

–Information theory – Collocations -N-gram Language Models – Estimating parametersand smoothing – Evaluating language models.

UNIT II :

WORD LEVEL AND SYNTACTIC ANALYSIS :Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III:

SEMANTIC ANALYSIS AND DISCOURSE PROCESSING :Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV :

NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION : Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations Application of NLG. Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

UNIT V :

INFORMATION RETRIEVAL AND LEXICAL RESOURCES :Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers-POS Tagger- Research Corpora

Text Books:

1. Natural Language Processingwith Python. Steven Bird, Ewan Klein, and Edward Lope, O'Reily, 2009
2. Natural Language Processing Recipes: Unlocking Text Data with Machine Learning andDeep Learning using Python. AkshayKulkarni,AdarshaShivananda, Apress, 2019

Suggested Reading:

References Books:

3. Allen James, Natural Language Understanding, Benjamin/Cumming,1995.
4. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.

SEMESTER-VII

COURSE 20: NATURAL LANGUAGE PROCESSING

Practical | Credits: 1 | 2 hrs/week

1. Text segmentation: Segment a text into linguistically meaningful units, such as paragraphs, sentences, or words. Write programs to segment text (in different formats) into tokens (words and word-like units) using regular expressions. Compare an automatic tokenization with a gold standard
2. Part-of-speech tagging: Label words (tokens) with parts of speech such as noun, adjective, and verb using a variety of tagging methods, e.g., default tagger, regularexpression tagger, unigram tagger, and n-gram taggers.
3. Text classification: Categorize text documents into predefined classes using Naïve BayesClassifier and the Perceptron model
4. Chunk extraction, or partial parsing: Extract short phrases from a part-of-speech tagged sentence. This is different from full parsing in that we're interested in standalone chunks, or phrases, instead of full parse trees
5. Parsing: parsing specific kinds of data, focusing primarily on dates, times, and HTML. Make use of the following preprocessing libraries:

- dateutil which provides datetime parsing and timezone conversion
- lxml and BeautifulSoup which can parse, clean, and convert HTML
- charade and UnicodeDammit which can detect and convert text character encoding

6. Sentiment Analysis: Using Libraries TextBlob and nltk, give the sentiment of a document

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SEMESTER-VIII

COURSE 21 A: RESEARCH EXPLORATION

Theory Credits: 3 3 hrs/week

Course Objective: The purpose of a research methodology is to explain the reasoning behind your approach to your research - you'll need to support your collection methods, methods of analysis, and other key points of your work. Think of it like writing a plan or an outline for youwhat you intend to do.

UNIT I – Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

UNIT II – Problem Identification & Formulation – Research Question – Investigation Question
– Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

UNIT III – Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive ResearchDesigns – concept, types and uses. Experimental Design: Concept of Independent & Dependentvariables.

UNIT IV – Qualitative and Quantitative Research: Qualitative research – Quantitative research
– Concept of measurement, causality, generalization, replication. Merging the two approaches. Meas-urement: Concept of measurement– what is measured? Problems in measurement in research – Va-lidity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

UNIT V – Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Ran-dom Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size

Text Books Recommended:-
Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
Research Methodology – C.R.Kothari.

SEMESTER-VIII

COURSE 21 A: RESEARCH EXPLORATION

Practical | Credits: 1 | 2 hrs/week

Research Exploration: Case Studies

The purpose of a research methodology is to explain the reasoning behind your approach to your research - you'll need to support your collection methods, methods of analysis, and other key points of your work. Think of it like writing a plan or an outline for you what you intend todo.

1. Apply the research concepts and tools to identify a research problem, sub-statements of theprob-lem to clarify the direction of research effort?
2. Construct a research framework showing the variables of the study relevant for a specific areaof inquiry
3. Design a research methodology by classifying the research design, population and samplingtech-niques suitable for a research problem.
4. Develop a research proposal by using principles and frameworks of research methodology tojustify an ethical, practical and effective research project.

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SEMESTER-VIII

COURSE 21 B: COMPUTATIONAL DATA SCIENCE

Theory Credits: 3 3 hrs/week

Aim and objectives of Course (Predictive and Advanced Analytics):
The course enables students to:

1. To learn descriptive statistics using computational tools
2. To learn distributions in probability.
3. To work with different types of dispersion measures.

Learning outcomes of Course (In consonance with the Bloom's Taxonomy):The students will be able to:

- To understand different computational tools and statistical techniques.
- To learn about curve fitting in data science.
- Able to perform visual diagnostics.

UNIT I
Data Science Computational Tools - Statistical Techniques -Plotting the Classics - Literary Charac-ters - Causality and Experiments - Tables -Randomness - Conditional Statements - Iteration - Simulation .

UNIT II
Finding Probabilities - Sampling and Empirical Distributions - Empirical Distributions - Sampling from a Population - Empirical Distribution of a Statistic - Testing Hypotheses - Assessing Models - Multiple Categories - Decisions and Uncertainty - Error Probabilities.

UNIT III
Comparing Two Samples - A/B Testing –Deflategate - Causality - Estimation – Importance ofMean- Properties of the Mean - Variability - The SD and the Normal Curve.

UNIT IV
The Central Limit Theorem - The Variability of the Sample Mean - Choosing a Sample Size - Predic-tion - Correlation - The Regression Line - The Method of Least Squares - Least SquaresRegression

UNIT V
Visual Diagnostics -Numerical Diagnostics. Inference for Regression - A Regression Model -Inference for the True Slope - Prediction Intervals

TEXT BOOK:
1. Ani Adhikari and John DeNero, David Wagner "Computational and Inferential Thinking: TheFoundations of Data Science", 2019.
2. Web link: https://inferentialthinking.com/chapters/intro.html

REFERENCES:

1. The Art of Data Science: A Guide for Anyone Who Works with Data, Roger D. Peng, andEliz-abeth Matsui, ISBN: 9781365061462, 2018.
2. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios.by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave, ISBN: 1119282713,2017

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SEMESTER-VIII

COURSE 21 B: COMPUTATIONAL DATA SCIENCE

Practical Credits: 1 2 hrs/week

1. Project Gutenberg is a website that publishes public domain books online. Using Python,load the text of two classic novels directly from the web.
2. Create a Table, add new columns, add data, move data to a table using cvs file, access thedata in a column and choose sets of columns.
3. Perform scatter Plots and Line Graphs using Python(https://inferentialthinking.com/chapters/07/Visualization.html)
4. Write a Program that simulates Multiple values
5. Based on the top_movies_2017.csv data set,draw some samples, create a deterministic sample,find probability sample and find systematic sam-ple.(https://inferentialthinking.com/chapters/10/Sampling_and_Empirical_Distributions.html)
6. Simulate one value, multiple value of the statistic and visualise the results in an empirical history ram circuits.(https://inferentialthinking.com/chapters/11/1/Assessing_a_Model.html)
7. Under A/B Testing, observed difference, Predict the static under null hypothesis, and performpermutations test.
8. Using Central Limit theorem, find out the average flight delay from the database ‘unit-ed_summer2015.csv.’

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SEMESTER-VIII

COURSE 22 A: COMPUTER VISION WITH PYTHON

Theory Credits: 3 3 hrs/week

Course Outcomes:

- This course enables the learners to understand the advancedconcepts in computer vision.
- The course covers the basics of image processing, imaginggeometry, image segmentation, feature extraction, object recognition and classification and common applications ofcomputer vision.
- This course helps the students to design solutions for complexreal-life problems.

Unit – 1 (Image Formation and Processing) Image formation and Image model- Components of a vision system- Cameras- camera model and camera calibration-Radiometry- Light in space- Light insurface - Sources, shadows and shading. Fundamentals of Image processing: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels.

Unit - 2(Feature Extraction) Points and Patches – Feature detectors,feature descriptors, feature matching, feature tracking. Edges – edgedetection, edge linking. Lines - Successive approximation, Hough transforms, Vanishing points.

Unit - 3 (Image Segmentation) Classification of segmentation techniques, Edge detection, Edge linking, Thresholding, Region growing, Region splitting and merging, Watershed based segmentation. Shadow detection and removal. Image processing using OpenCV - blending, smoothing, and reshaping.

Unit - 4 (Image Recognition and Classification) Shape based object classification, Motion based object classification, Viola Jones Object Detection Framework, Object classification using CNNs, use of RCNN for object classification.

Unit - 5 (Applications) Speech and Handwriting Recognition, Automatic Face Recognition, Video Segmentation and KeyframeExtraction, Real-Time Hand Pose Recognition.

Text Books:

1. David A. Forsyth & Jean Ponce, Computer vision – A Modern Approach, Prentice Hall, 2002.

2. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer.

3. Maheshkumar H Kolekar, "Intelligent Video Surveillance Systems: An Algorithmic Approach", CRC Press. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

4. Francesco Camastra, Alessandro Vinciarelli, "Machine Learning for Audio, Image and Video Analysis: Theory and Applications", Springer 2015.

Reference Books 1. Reinhard Klette, "Concise Computer Vision: An Introduction into Theory and Algorithms", Springer London, 2014.

2. Olivier Faugeras, "Three-Dimensional Computer Vision", The MITPress, 1993.

SEMESTER-VIII

COURSE 22 A: COMPUTER VISION WITH PYTHON

Practical | Credits: 3 | 3 hrs/week

1. Reducing the Number of Intensity Levels in an Image.
2. Zooming and Shrinking Images by Pixel Replication.
3. Zooming and Shrinking Images by Bilinear Interpolation.
4. Arithmetic Operations.
5. Image Enhancement Using Intensity Transformations.
6. Histogram Equalization.
7. Spatial Filtering.
8. Enhancement Using the Laplacian.
9. Unsharp Masking

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SEMESTER-VIII

COURSE 22 B: DATA WRANGLING WITH JAVA SCRIPT

Theory Credits: 3 3 hrs/week

Course Outcomes:
Aim and objectives of Course (Predictive and Advanced Analytics):The course enables students to:

- To learn how to use REST APIs.
- To learn different types of data formats.
- To learn connectivity of different databases like MYSQL , MongoDB.

Learning outcomes of Course (In consonance with the Bloom's Taxonomy):The students will be able to:

- To learn working with NodeJS
- To learn how to host a server and run a server in local host.
- Importing and exporting data from different data formats.
- Develop a web visualization application

UNIT I

Getting started: establishing your data pipeline - Why data wrangling- What's data wrangling - Why use JavaScript for data wrangling- Is JavaScript appropriate for data analysis? Navigatingthe Ja-vaScript ecosystem - Establishing your data pipeline

UNIT II

Getting started with Node.js - Building a simple reporting system - Getting the code and data - Viewing the code - Installing Node.js - Running Node.js code -Running a web application - Getting the data - Checking your Node.js version -Working with Node.js Creating a Node.js project - Creat-ing a command-line application - Creating a code library - Creating a simple web server - Asynchro-nous coding - Loading a single file - Loading multiple files - Error handling - Asynchronous coding with promises - Wrapping asynchronous operations.

UNIT III

Acquisition, storage, and retrieval -Getting the code and data -The core data representation- Loading data from text files - Loading data from a REST API-Parsing JSON text data- Parsing CSV text data- Importing data from databases - Importing data from MongoDB- Importing data from MySQL - Exporting data - Exporting data to text files - Exporting data to JSON text files -Exporting data to CSV text files- Exporting data to a database - Exporting data to MongoDB- Exporting data to MySQL.

UNIT IV

Exploratory coding - Iteration and your feedback loop - A first pass at understanding your data -Working with a reduced data sample - Prototyping with Excel - Exploratory coding with Node.js

-Using Nodemon -Exploring your data -Using Data-Forge - Computing the trend column - Output-ting a new CSV file

UNIT V

Exploratory coding in the browser - Clean and prepare - The need for data cleanup and preparation

- Where does broken data come from? - How does data cleanup fit into the pipeline- Identifying bad data - Techniques for fixing bad data - Cleaning our data set -Preparing our data for effectiveuse.

TEXTBOOK :

1. Data Wrangling with JavaScript - Ashley Davis - Manning Publication

REFERENCE TEXTBOOKS :

1. Principles of Data Wrangling - Practical Techniques for Data Preparation - Tye Rattenbury, Joseph M. Hellerstein, Jeffrey Heer, Sean Kandel, Connor Carreras - Oreilly Publication.
2. Data Wrangling with Python - Jacqueline Kazil, Katharine Jarmul 2016- Oreilly Publication

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SEMESTER-VIII

COURSE 22 B: DATA WRANGLING WITH JAVA SCRIPT

Practical | Credits: 1 | 2 hrs/week

1. Install Node.js and install dependencies
2. Run one web application and get the data
3. Install “Express Node.js framework” . Create a simple Web application to print yourcollege name on Web Page.
4. Create a simple web server and add static files to it
5. Add a REST API to web server to dynamically generate a report.
6. Loading your input CSV file and printing its contents to the console. Apply slicing operation on data and print on Console. Print datatype of each column(attribute) of CSVfile.
7. Retrieve data from REST API
8. Import Earthquakes data from REST API
9. Import data from MySql
10. Use HTTP GET to retrieve the data from your CSV file.
11. Develop a program to clean your data by rewriting rows to fix bad data.
12. Develop a web visualization application by importing data from Excel file.

SEMESTER-VIII

COURSE 23 A: SOCIAL MEDIA ANALYTICS

Theory | Credits: 3 | 3 hrs/week

OBJECTIVES

To Understand the Complete Architecture of Social MediaAnalytics

- To know Web analytics tools
- To know the social media of ongoing campaigns

OUTCOMES

- Students will get well knowledge of what is Social Media AnalyticsKnowledge in Web analytics tools
- Mapping of Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc.)

UNIT-I

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods.

UNIT-II

Graphs and Matrices- Basic measures for individuals and networks. Information visualization Making connections: Link analysis. Random graphs and network evolution. Social contexts:Affiliation and identity. Web analytics tools and techniques: Click stream analysis, A/B testing,online surveys.

UNIT-III

Web crawling and Indexing; Natural Language Processing Techniques for Micro-text Analysis Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reachand Engagement analysis.

UNIT-IV

Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification. Applications in Advertising and Game Analytics (Use of tools like Unity30 / PyCharm).Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration

UNIT-V

Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc.) Use of Google Analytics. Post Performance on FB, Use of Facebook Business Manager

Text Books:

1. Mathew Ganis, Avinash Koihrkar Social Media Analytics IBM Press 2015 / 1st2 Jim Sterne Social Media Metrics Wiley Latest

3 Oliver Blanchard Social Media ROI QuePublishing Latest

4 Marshall Sponder, Gorah F. KhanDigital Analytics for Marketing Routledge 2017 / 1st

Reference books:

1. 5 Marshall Sponder Social Media Analytics McGraw Hill Latest
2. 6Tracy L. Tuten, Michael R. Solomon Social Media Marketing Sage 2018 / 3rd
3. 7 Gohar F. Khan Creating Value With Social Media AnalyticsCreateSpaceIndependentPublishing 2018 1st
4. 8 Alex Gonsalves Social Media Analytics Strategy Appress 2017 / 1st

SEMESTER-VIII

COURSE 23 A: SOCIAL MEDIA ANALYTICS

Practical Credits: 1 2 hrs/week

Using Python Implement the following Programs

1. Managing text data2.Syntactical analysis

3.Vector semantics and latent semantic analysis (LSA) 4.Clustering and topic modeling:

PLSA, LDA, SLDA, ...

5. Text classification: naive Bayesian, maximum entropy, SVM, ...
6. Clustering Physician Reviews
7. Discovering Topics on Twitter8.Deep Learning with Text

9.Students should analyses the social media of any ongoing campaigns and present the findings.

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SEMESTER-VIII

COURSE 23 B: MAJOR PYSPARK ESSENTIALS FOR DATA

Theory Credits: 3 3 hrs/week

Course Outcomes:

- To learn PYSPARK, and to develop models
- To know the use of PYSPARK to automate model selection.
- To advice on when and how to use each model. Also learn how to combine two or more Models.

UNIT-I
Data Engineering
Distributed Computing Primer: Technical requirements, Distributed Computing, Distributed Computing with Apache Spark, Big data processing with Spark SQL and Data Frames.
Data Ingestion: Technical requirements, Introduction to Enterprise Decision Support Systems,ingesting data from data sources, ingesting data into data sinks, Using file formats for data storage in data lakes, Building data ingestion pipelines in batch and real time, Unifying batch and real time using Lambda Architecture.

UNIT-II
Data Cleansing and Integration: Technical requirements, transforming raw data into enriched meaningful data, building analytical data stores using cloud data lakes, consolidating data usingdata integration, Making raw data analytics-ready using data cleansing.
Real-Time Data Analytics: Technical requirements, Real-time analytics systems architecture, Stream processing engines, Real-time analytics industry use cases, Simplifying the Lambda Architecture using Delta Lake, Change Data Capture, Handling late-arriving data, Multi-hop pipelines.

UNIT-III
Data Science
Scalable Machine Learning with PySpark: Technical requirements, ML overview, Scaling out machine learning, Data wrangling with Apache Spark and MLlib.
Feature Engineering – Extraction, Transformation, and Selection: Technical requirements, The machine learning process, Feature extraction, Feature transformation, Feature selection, Featurestore as a central feature repository, Delta Lake as an offline feature store

UNIT-IV
Data Analysis
Data Visualization with PySpark:, Technical requirements, Importance of data visualization, Techniques for visualizing data using PySpark, Considerations for PySpark to pandas conversion.
Spark SQL Primer: Technical requirements, Introduction to SQL, Introduction to Spark SQL, Spark SQL language reference, Optimizing Spark SQL performance.

UNIT-V
Integrating External Tools with Spark SQL: Technical requirements, Apache Spark as a distributed SQL engine, Spark connectivity to SQL analysis tools, Spark connectivity to BI tools, Connecting Python applications to Spark SQL using Pyodbc The Data Lakehouse: Moving from BI to AI, The data lakehouse paradigm, Advantages of data lakehouses.

Text Books:

1. Essential PySpark for Scalable Data Analytics, by Sreeram Nudurupati, Packt Publishing, 2021.
2. Applied Data Science Using Pyspark, by Ramcharan Kakarla, Sundar Krishnan, Sridhar Alla,Apress, Springer India

Reference Books:

1. Machine Learning with Pyspark, by Pramod Singh, Apress India
2. Learning Pyspark, by Tomasz Drabas Denny Lee, Packt Publications, 2017.PYSPARK ESSENTIALS FOR DATA SCIENCE LAB

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SEMESTER-VIII

COURSE 23 B: MAJOR PYSPARK ESSENTIALS FOR DATA

Practical Credits: 1 2 hrs/week

1. Installing PySpark
2. Demonstrate on Big Data concepts in PythonLambda Functions

Filter(), map(), amd reduce()Sets.

3. Hello World in PySpark
4. PySpark API and Data Strtuctures
5. Running PySpark Programs in

- Jupyter Notebook
- Command-Line Interface
- Cluster
- PySpark Shell

6. Combining PySpark with other Tools
7. Demonstrate on Data Cleaning with PySpark
8. Demonstrate on Data wrangling with Apache Spark and MLlib
9. Demonstrate Data Visualization with PySpark
10. Demonstrate Connecting Python applications to Spark SQL using Pyodbc

SEMESTER-VIII

COURSE 24: BUSINESS INTELLIGENCE AND VISUALIZATION

Theory Credits: 3 3 hrs/week

OBJECTIVES:

The student should be made to be familiar with the Business intelligence architectures most fundamental Graphs and results.

Be exposed to the techniques of proofs and analysis.

Detailed Syllabus: (Five units with each unit having 12 hours of class work)UNIT-I

BUSINESS INTELLIGENCE: Effective and timely decisions - Data, information, and knowledge - Role of mathematical models - Business intelligence architectures: Cycle of a business intelligence analysis - Enabling factors in business intelligence projects

UNIT-II

KNOWLEDGE DELIVERY: The business intelligence user types. Standard reports. Interactive Analysis. and Ad Hoc Querying, Parameterized Reports: and self-Service Reporting,dimensional analysis Analysis/notifications, Visualizations: Charts, Graphs, Widgets, Scorecards, and Dashboard.

UNIT- III

EFFICIENCY: Efficiency measures -The CCR model: Definition of target objectives- peer groups - Identification of good operating practices; cross-efficiency analysis - virtual inputs andoutputs - Other models. Pattern matching -cluster analysis, outlier analysis

UNIT-IV

BUSINESS INTELLIGENCE APPLICATIONS: Marketing model- Logistic and Production models

-Case studies. Development of a business intelligence system -Ethics and business intelligence.Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

UNIT- V

FUTU RE OF BUSINESS INTELLIGENCE: Future of business intelligence - Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics - Advanced Visualization -Rich Report, Future beyond Technology.

TEXT BOOK:

I. Efraim Turban, Ramesh Sharda, Dursun Deleo, "Decision Support and Business

IntelligenceSystems". 9th Edition, Pearson 20 13.

.

REFERENCES:

I. Larissa T. Moss, S. Acre, "Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making", Addison Wesley,2003.

2. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making ", Wiley

Publications,2009.

3. David Loshin Morgan, Kaufman. "Business Intelligence: The Savvy Managers Guide", Second Edition,20 12.

4. Cindi Howson, "Successful Business Intelligence: Secret< to Making Bl " Killer

App".McGraw-Hill,2007.

s. Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy, Bob Becker, "The DataWarehouse Lifecycle Toolkit", Wiley publication lnc.,2007.

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SEMESTER-VIII

COURSE 24: BUSINESS INTELLIGENCE AND VISUALIZATION

Practical Credits: 1 2 hrs/week

Practical 1: Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.)and load in the target system.

Practical 2: Perform the Extraction Transformation and Loading (ETL) process to construct thedatabase in the Sqlserver / Power BI.

Practical 3: Data Visualization from ETL Process Power BI DesktopPractical 4: Creating a Cube in SQL server 2012

Practical 5: Apply the what – if Analysis for data visualization. Design and generatenecessary reports based on the data warehouse data.

Practical 6: Implementation of Classification algorithm in R Programming.Practical 7: Practical Implementation of Decision Tree using R Tool Practical 8: k-means clustering using R

Practical 9: Prediction Using Linear Regression Practical 10: Data Analysis using Time Series Analysis

Practical 11: Data Modelling and Analytics with Pivot Table in ExcelPractical 12: Data Analysis and Visualization using Advanced Excel