ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Programme: B.Sc. Honours in Artificial Intelligence (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	Python for Data Science	3	3
			Python for Data Science Lab	2	1
		4	Statistical Methods and Probability Distribution	3	3
			Statistical Data Analysis Using SPSS - I Lab	2	1
II	III	5	Document Oriented Database	3	3
			Document Oriented Database Lab	2	1
		6	Operating Systems	3	3
			Operating Systems Lab	2	1
		7	Introduction to OOP using JAVA	3	3
			Introduction to OOP using JAVA Lab	2	1
		8	Inferential Statistics	3	3
			Statistical Data Analysis Using SPSS - II Lab	2	1
	IV	9	Data Warehousing and Data Mining	3	3
			Data Warehousing and Data Mining Lab	2	1
		10	Machine Learning using Python	3	3
			Machine Learning using Python Lab	2	1
		11	Introduction to AI	3	3
			Introduction to AI Lab	2	1
III	V	12	Introduction to Predictive Analytics using Python	3	3
			Introduction to Predictive Analytics using Python Lab	2	1
		13	Algorithms for Intelligent Systems	3	3
			Algorithms for Intelligent Systems Lab	2	1
		14	Natural Language Processing	3	3
			Natural Language Processing Lab	2	1
		15	Software Project Management	3	3
			Software Project Management Lab	2	1

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
	VI	Semester Internship/Apprenticeship with 12 Credits			
IV	VII	16	Deep Learning	3	3
			Deep Learning Lab	2	1
		17	Text Mining	3	3
			Text Mining Lab	2	1
		18	Computer Networks	3	3
			Computer Networks Lab	2	1
		19	Mobile Application Development	3	3
			Mobile Application Development Lab	2	1
		20	Big Data Analysis using R	3	3
			Big Data Analysis using R Lab	2	1
	VIII	21	Neural Networks	3	3
			Neural Networks	2	1
		22	Design Thinking	3	3
			Design Thinking	2	1
		23	Robotics and Intelligent Systems	3	3
			Robotics and Intelligent Systems Lab	2	1
		24	Cyber Security Essentials	3	3
			Cyber Security Essentials	2	1
		25	Big Data Analysis using SPARK	3	3
			Big Data Analysis using SPARK Lab	2	1

SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL ANDCHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of theessential 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 networksecurity 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 and problems **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 properties2:

Trigonometric Ratios Problem Solving

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

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 statisticalmeasures 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 orelectric 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 theresults.
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) thatshowcases 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 ontheir 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 andbases or observing a combustion reaction.
Students will observe and describe the chemical changes that occur, including changes incolor, 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 thatinvolve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integrationof 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**.**

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 recentadvances 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 ofintersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product ruleand 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 ofa 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 chemicalpollutants 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, suchas slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including theirslopes, 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 andapply 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 andchemistry

4: Matrices Manipulation

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

Students can apply their knowledge of matrices to real-world applications, such as solvingsystems 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, andpropose 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: renewableenergy, nanotechnology, biophysics, medical physics, or shape memory materials.

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

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

They will discuss the implications of their experimental results in the context of recentadvances 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 virtualscreening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity andselectivity 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, anddraw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems 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 withchemical pollutants.
For the dye removal using the catalysis method, students can explore case studies wherecatalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of thecatalysis 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 anano 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, analyzedata, 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. Forexample, 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 specificapplication area.
2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modellingin 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 potentialadvancements in the field.

Students will present their findings and engage in critical discussions on the advantages andlimitations 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 wastemanagement 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 numbersystems

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

SEMESTER-II

COURSE 3: PYTHON FOR DATA SCIENCE

Theory Credits: 3 3 hrs/week

Course Objective:

The objective of this course is to study main elements of python programming and perform data analysis using data structures and tools in python.

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	**PROGRAM OUTCOME NO**
CO1	To Understand Features and basic concepts of python.	PO5, PO7
$CO2_2$	To learn control structures in python and apply them to real world problems.	PO5, PO7
$CO3_3$	To implement functions and modules in python.	PO5, PO7
$CO4_4$	To understand data structures in python. oops concepts	PO5, PO7
$CO5_5$	To construct data and perform data analysis.	PO5, PO7

UNIT-1: Basics of Python

Features of python, literal constants-numbers, variables, identifiers, data types, input operation, comments, operators, operations on strings, other data types, type conversion.

Selection or conditional branching statements-if, if else , nested if, if elif else, loops or iterative statements-while, for, nested loops, break, continue, pass, else statement with loops.

UNIT-2: Functions and Modules

Functions-Definition and call, return statements, anonymous function- LAMBDA, recursive functions. **Modules-**Using existing modules, making own modules, packages in python, Names of standard library modules.

UNIT-3: Data Structures

List-Accessing lists, updating lists, nested lists, basic list operations, list methods, loops in lists.

Tuples-Creation, Accessing, updating, deletion in tuples and basic tuple operations.
Sets-creation, set operations.

Dictionaries - creation, accessing, adding and modifying items, deleting items.

UNIT-4: Object Oriented Programming concepts .

Oops concept- Introduction, Classes and Objects, Class method Inheritance Introduction Inheriting classes in python Types of Inheritance, Error and Exception Handling

UNIT-5: Data Analysis .

Data preparation using pandas and series: pandas data frame basics**,** Creating your own data , Series, Data frames, Making changes to series and data frames
Plotting: Matplotlib Introduction, Univariate plots-Histograms

Text Books:

1. **Python Programming Using Problem Solving Approach** –Reema Thareja , Oxford University Press, ©2017
2. **Pandas for Everyone (Python data Analysis)-**Daniel Y.Chen, Pearson Addison Wesley Data and Analytics series,©2018.

Recommended Co – Curricular Activities:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-II

COURSE 3: PYTHON FOR DATA SCIENCE

Practical Credits: 1 2 hrs/week

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO_1	Implement a given problem as a python program.	PO5, PO7
CO_2	To write loops and decision statements in Python	PO5, PO7
CO_3	To implement functions and modules in Python.	PO5, PO7
CO_4	To implement different data structures in python	PO5, PO7
CO_5	To implement data analysis using pandas and graphs	PO5, PO7

Experiments List

1. Write a program to read and print values of variables of different data types.
2. Write a program to find the roots of quadratic equations.
3. Write a program to find the largest of 3 numbers.
4. Write a program to check whether a given number is prime or not.
5. Write a program to generate Fibonacci series.
6. Write a program to find whether a given number is Armstrong or not.
7. Write a program using functions to swap two numbers.
8. Write a program to find factorial of a number using recursion .
9. Write a program to find square root of a given mumber using math module.
10. Write a program to generate 10 random numbers between 1 to 100 using random module.
11. Create a list and perform different operations on it.
12. Create a tuple and perform different operations on it.
13. Create a set and perform different operations on it.
14. Create a dictionary and perform different operations on it.
15. Import pandas and create a dataframe and perform operations on it.
16. Generate histogram using Matplotlib.
17. Generate scatter plot using Matplotlib.
18. Generate box plot using Matplotlib.

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SEMESTER-II

COURSE 4: STATISTICAL METHODS AND PROBABILITY DISTRIBUTION

Theory Credits: 3 3 hrs/week

Course Objective: The purpose is to familiarise the students about the basic concepts required for artificial intelligence and Machine learning.

Course Outcomes: **After successfully completing this course, the students will acquire:**
CO1: know about correlation and regression techniques, the two very powerful tools in statistics,

CO2: study concept of coefficient of determination and inference on partial and multiple correlation and regression coefficients.

CO3: knowledge of important discrete distributions such as Binomial, Poisson, Geometric, Negative Binomial and Hyper geometric and their interrelations if any,

CO4:knowledge of important continuous distributions such as Uniform, Normal, Exponential and Gamma and relations with some other distributions,

CO5: basic knowledge of complete enumeration and sample, sampling frame, sampling distribution, sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,

Unit I
Correlation Analysis
Meaning Measures of Correlation- Scatter diagram, Karl Pearson's and Spearman's rank correlation. Calculation of the correlation coefficient for bi-variate frequency distribution Multiple and Partial correlation(3 variables only)

Unit II
Curve fitting and Regression Analysis:
Principle of least squares, fitting of straight line, second degree polynomial or parabola, power and exponential curves**. Regression:** Introduction, Linear Regression- Regression coefficients and its properties, Angle between two lines of regression. Standard error of estimate (residual variance), Explained and Unexplained variation, coefficient of determination. Multiple Linear Regression(3 variables only) and Logistic Regression.

Unit III Discrete Probability Distributions:

Uniform, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric distributions along with their characteristic properties, applications and limiting/approximation cases.

Unit IV
Continuous probability distributions: Normal, Exponential, Uniform, Beta, Gamma, distributions along with their characteristic properties, applications and limiting/approximation cases.

Unit V
Basic concepts: population and sample, census and sample survey, sampling frame, sampling distribution, standard error, sampling design, sampling and non-sampling errors, sample surveys, principles of sample survey, principal steps in sample survey, limitations of sampling, Sample survey versus complete enumeration survey. Types of sampling - Simple random sampling, stratified sampling, systematic sampling, and cluster sampling (only concept)

Note: without proofs of named theorems and more importance to applications

Text Book(Unit I to IV): Fundamentals of Mathematical Statistics, 12th Edition, 10th September 2020, S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi.

Text Book(Unit V) : Fundamentals of Applied Statistics, 4th Edition, 1st January 2014,(ISBN-10 : 8180547051)S. C. Gupta and V. K. Kapoor, Sultan Chand & Sons, New Delhi.

Recommended References books:

1. Mathematical Statistics with Applications, 2009, K.M.Ramachandran and Chris P.Tsokos Academic Press(Elsevier), Haryana .
2. Probability and Statistics,Volume I, D.Biswas, New central book Agency (P) Ltd, New Delhi.
3. An outline of Statistical theory, Volume Two,3rd Edition,2010(with corrections) A.M.Goon,M.K. Gupta, B.Dasgupta ,The World Press Pvt.Ltd., Kolakota.
4. Sanjay Arora and BansiLal:. New Mathematical Statistics, SatyaPrakashan , New Delhi.

Websites of Interest: **http://onlinestatbook.com/rvls/index.html**

Co-Curricular Activities in the class:

1. Pictionary
2. Case Studies on topics in field of statistics
3. Snap test and Open Book test
4. Architectural – To be build the procedures
5. Extempore – Random concept to students
6. Interactive Sessions
7. Teaching through real world examples

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SEMESTER-II

COURSE 4: STATISTICAL METHODS AND PROBABILITY DISTRIBUTION

Practical Credits: 1 2 hrs/week

Course Objective:

This course enables students to gain hands-on practical experience of SPSS for analysing data.

CO.NO	Upon successful completion of this course, students should have the knowledge and skills to:	POS
CO1	Apply the various statistical methods for real life problems	PO2
CO2	Analyze the uni-variate and bivariate data using statistical techniques.	PO2

List of Practicals using SPSS

1. Diagrams & Graphs- Bar, Pie , Histogram, frequency polygon, and Ogive curves
2. Computation of measures of central tendency- Arithmetic Mean, Geometric mean and Harmonic Mean – Grouped Data.
3. Computation of measures of central tendency- Median, Mode and Partition Values - Grouped Data.
4. Computation of measures of Dispersion – Quartile Deviation, Mean Deviation, Standard Deviation, Variance and Coefficient of Variation – Grouped Data.
5. Computation of non-central, central moments, β_1 and β_2 and Sheppard's corrections for grouped data.
6. Computation of Karl Pearson's coefficients, Bowley's coefficients of Skewness and coefficients of Skewness based on moments – Grouped Data
7. Computation of correlation coefficient and regression lines for (i) ungrouped data (ii) grouped bivariate data
8. Construction regression line equations for (i) ungrouped data (ii) grouped bi-variate data.

Note: Training shall be in SPSS and derive the results. The SPSS output shall be exported to MS word for writing inference.

Reference Manual: Practical Manual -Prepared by the Department Faculty Members

Websites of Interest: http://www.statsci.org/datasets.html

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SEMESTER-III

COURSE 5: DOCUMENT ORIENTED DATABASE

Theory Credits: 3 3 hrs/week

Course Objective:

- To educate student regarding databases and how to manage databases.
- To handle the large amount of data handling demands of business
- To implement a data store that provides high performance, high availability, and automatic scaling
- To Process an immense diversity of data that needs to be stored and processed.
- To make use of features and functionalities to work on NO SQL Data Base Mongo DB

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to: \	PROGRAM OUTCOM NO
CO1	Have knowledge about database and DBMS Architecture	PO5, PO7
CO2	Able to know No SQL databases, various features of Mongo DB, the installation procedure, and how to interact with MongoDB.	PO5, PO7
CO3	Able to work on Mongo DB's rich query language to support create,read, update, and delete (CRUD) operations.	PO5, PO7
CO4	Analyses the aggregation framework to perform aggregation operations.	PO5, PO7
CO5	Able to work on indexes, types of index, index properties, and the various indexing strategies to be considered. Indexes are used to improvethe performance of a query.	PO5, PO7

Unit –I

Overview of Database Management Systems:

Introduction ,Data and Information , Characteristics of the Database Approach - Self-Describing Nature of the a Database System , Insulation between Programs and Data, Data Abstraction , Support of Multiple Views of the data , Sharing of Data and multiuser Transaction Processing , Actors on the Scene - Database Administrators , Database Designers , End Users , System Analysts and Application Programmers , Advantages of using a DBMS - Controlling Redundancy ,Restricting unauthorized Access , Providing Persistent Storage for Program Objects and Data Structures, Permitting Inferencing and Actions Using Rules ,Providing Multiple User Interfaces , Representing Complex Relationships Among data , Enforcing Integrity Constraints , Providing Backup and Recovery ,Database System Concepts and Architecture , DBMS Architecture and Data Independence - The Three-Schema Architecture , Data Independence , Database Languages and Interfaces.

Unit – II

Mongo DB Features and Installation, The Need for No SQL Databases, What Are No SQL Databases?

CAP Theorem, BASE Approach, Types of NoSQL Databases, MongoDB Features, Document Database

MongoDB Is Schemaless MongoDB Uses BSON , Rich Query Language, Terms Used in MongoDB, Data Types in MongoDB, Working with Database Commands, Create Database, Drop Database.

Unit III

MongoDB CRUD Operations, Collections, Create a Collection, Create Capped Collections, Create Operations, Insert Documents, Read Operations, Query Documents, Update Operations, Update Documents, Delete Operations, Delete Documents, Working with Arrays.

Unit IV

Data Modelling and Aggregation, Data Models, Embedded Data Models, Normalized Data Models Data Model Relationship Between Documents, Data Model Using an Embedded Document, Data Model Using Document References.

Unit V

Indexes and Working with Indexes, Index Types, Index Properties, Indexing Strategies.

Text Book:

1. "Fundamentals of Database Systems" by R.Elmasri and S.Navathe
2. "Database System Concepts" by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill, 2010.
3. MongoDB Recipes: With Data Modeling and Query Building Strategies By Subhashini Chellappan, Dharanitharan Ganesan , Publisher : Apress

Reference Book:

1. "Database Management Systems" by Raghu Ramakrishnan, NcGrawhill,2002
2. "Prinicples of Database Systems" by J.D.Ullman
3. MongoDB Basics 1st ed. Edition , by Peter Membrey (Author) Publisher : Apress Web Resources

Web Links:

1. https://docs.mongodb.com/manual/tutorial/getting-started
2. https://www.tutorialspoint.com/mongodb/index.htm

Recommended Co – Curricular Activities:

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

1. Programming exercises,
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Individual and group project reports.
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.
7. Computerized adaptive testing, literature surveys and evaluations,
8. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-III

COURSE 5: DOCUMENT ORIENTED DATABASE

Practical Credits: 1 2 hrs/week

Course Objective:

The objective of this course is to enable student to implement database related queries using MongoDB.

COURSE OUTCOME	UPON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS SHOULD HAVE THE KNOWLEDGE AND SKILLS TO	PROGRAM OUTCOME NO
CO1	Installation of mongo db ,configuring, running mongo db	PO5, PO7
CO2	Implementation of crud operations	PO5, PO7
CO3	Implementing index methods, aggregation methods	PO5, PO7
CO4	To study and implement DDL, DML commands using MYSQL	PO5, PO7
CO5	Implementing MySQL Programmes using Control Structures and functions.	PO5, PO7

WEEK 1:

Installing configuring running of Mongo db

Week 2:

Working with data base commands in mongo db

Week 3:

Working with crud operations in mongo db

Week 4:

Implementing aggregation operations in mongo db

Week 5:

Implementing index operationsWeek 6:

Working with create, alter, drop, rename and Truncate tables using MYSQL

Week 7:

Working with insert, update, delete, select statements using MYSQL

Week 8:

Write an MYSQL Program to retrieve the data from two tables using joins.

Week 9:

Write a MYSQL program to retrieve and display the names of the top5 students with highest marks in a specified course.

Week 10:

Write an MYSQL Program to calculate the average marks of all students and display it along with their name.

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SEMESTER-III

COURSE 6: OPERATING SYSTEMS

Theory Credits: 3 3 hrs/week

Course Objectives

1. To understand the services provided by and the design of an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand different approaches to memory management.
4. To understand the structure and commands in unix
5. Students should be able to understand shell programming

Course Outcomes:

COURSE OUTCOME NO	UPON SUCCESSFUL COMPLETION OF THIS COU SHOULD HAVE THE KNOWLEDGE AND SKILLS	PROGRAM OUTCOME
CO1	Analyse the services and functions of operating systems	**PO5,PO7**
Co2	Analyse the concepts of processes in operating system and illustration of the scheduling of processor for a given problem instance.	**PO5,PO7**
Co3	Analyse memory management techniques, concepts of virtual memory	**PO5,PO7**
Co4	To understand Introduction to Unix:- Architecture of Unix, Features of Unix , Unix Commands	**PO5,PO7**
Co5	To understand **Shell programming and** Simple shell program examples	**PO5,PO7**

UNIT – I

Operating System:

Introduction, Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations. Evolution of Operating Systems ,types of operating system, Simple ,Batch, Multi programmed, time shared, Parallel, Distributed Systems, Real-Time Systems, Operating System services.

UNIT – II

Process and CPU Scheduling –

Process concepts The Process, Process State, Process Control Block, Process communication. Threads. Process Scheduling Scheduling Queues, Schedulers, Context Switch, Pre-emptive Scheduling, Dispatcher, Scheduling Criteria, Scheduling algorithms,Process Synchronization, The Critical section Problem, Semaphores, Classic Problems of Synchronization,

UNIT – III

Memory Management and Virtual Memory –

Logical & physical Address Space, Swapping, Contiguous Allocation, Paging-Structure of Page Table Segmentation, Segmentation with Paging,Virtual Memory, Demand Paging, Performance of Demanding Paging Page Replacement Page Replacement Algorithms, Allocation of Frames.

UNIT – IV

Introduction to Unix:- Architecture of Unix, Features of Unix , Unix Commands – PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip.

UNIT – V Shell programming:

Ordinary and environment variables. The profile. Read and read only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples.

TEXT BOOK:

"Operating System Concepts"-Silberschatz, Galvin, Gagne-–eight Edition-John Willey & Sons INC 1,2,3 units

Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill(4,5) units

REFERENCES BOOKS:

1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition, Wiley Student Edition.
2. Principles of Operating Systems by Naresh Chauhan, OXFORD University Press

Student Activity:

1. Load any new operating system into your computer.
2. Partition the memory in your system
3. Create a semaphore for process synchronization.

Recommended Co – Curricular Activities:

Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

1. Programming exercises,
2. Practical assignments and laboratory reports,

3. Observation of practical skills,
4. Individual and group project reports.
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.
7. Computerized adaptive testing, literature surveys and evaluations,
8. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-III

COURSE 6: OPERATING SYSTEMS

Practical Credits: 1 2 hrs/week

Course Objective:

This course enables students to develop OS scheduling logics and also to gain hands-on experience of UNIX OS..

COURSE OUTCOME NO	UPON SUCCESSFUL COMPLETION OF THIS COURSE, STUDENTS SHOULD HAVE THE KNOWLEDGE AND SKILLS TO:	PROGRAM OUTCOME NO
CO1	To implement CPU scheduling algorithms in c programming language	Po5,po7
CO2	To implement file/directory handling commands in Unix.	Po5,po7
CO3	To display list of currently logged users in Unix shell script	Po5,po7
CO4	To implement binary search using shell script	Po5,po7
CO5	To implement Fibonacci series using shell script	Po5,po7

LAB LIST

1. Write the program to implement CPU scheduling algorithm for first come first serve
2. Scheduling
3. Write the program to implement CPU scheduling algorithm for first come first serve
4. Scheduling
5. Write a program to implement CPU scheduling algorithm for shortest job first scheduling.
6. write a program to implement CPU scheduling algorithm for shortest job first scheduling.
7. Write a ‘C’ program to perform priority scheduling.
8. Write a ‘C’ program to perform priority scheduling.
9. Write a program to implement CPU scheduling for Round Robin Scheduling.
10. Execute various file/directory handling commands in UNIX.
11. Execute various file/directory handling commands in UNIX.
12. Write a Simple shell script for basic arithmetic and logical calculations.
13. Write a shell script to display list of users currently logged in.
14. Write a shell script to delete all the temporary files.
15. Write a shell script to search an element from an array using binary searching.
16. Write a shell script to determine whether a given number is a prime number or not
17. Write a shell script to print the first *n* Fibonacci numbers.
18. Execute various system administrative commands

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SEMESTER-III

COURSE 7: OBJECT ORIENTED PROGRAMMING

Theory Credits: 3 3 hrs/week

Course Objectives:

The Objective of the course is to assist the student in understanding the concepts of Object Oriented Programming using Java language.

Course Outcomes: At the end of this course the student is able to

CO1: Overview of java programming, history and its features**.(PO5,PO7)**

CO2: Understand fundamentals of programming such as variables, conditional and iterative execution, statements, etc**.(PO5,PO6,PO7)**

CO3: Understand the principles of arrays, inheritance, packages and multi-threading**.(PO5,PO6,PO7)**

CO4: Understand the Fundamental features of Managing Errors, Exceptions and Applet Programming**.(PO5,PO6,PO7)**

CO5: Understand the Files concept in java**.(PO5,PO6,PO7)**

UNIT -I

JAVA Evolution: History – Features, Overview of Java Language: Introduction - Simple Java program - Structure - Java tokens - Statements - Java virtual Machine.
Constants - Variables - Data types - Operators and expressions.

UNIT -II

Decision making and Branching: Simple If Statement, the IF…Else statement, The Else... If ladder, The Switch Statement, The? : Operator, Decision making and looping: The While statement, The do Statement - The for Statement - Jumps in loops - labelled loops - Classes, Objects and Methods. Arrays, Strings

UNIT -III

Vectors – Interfaces- Multiple Inheritance – Packages: Putting classes together –Threaded Programming - Thread life cycle, Multi threads, Deadlocks. Managing Errors and Exceptions, I/O Exceptions.

UNIT -IV

Applet Programming – advantages and disadvantages of Applets, Applet life cycle - Event Handling in Applet, Applet Parameters and Communications; Graphics programming: The Graphics class-Lines and rectangles-Circles and ellipses-Drawing arcs -Line graphs -Drawing Bar charts.

UNIT -V

Files: Introduction – concept of streams – Stream classes – Using stream – I/O classes – File class – creation of files – Reading / Writing characters/ Bytes.

Text Books:			
	Author	**Title**	**Publisher**
1	E. Balaguruswamy,	Programming with JAVA - A Primer, 2015	McGraw Hill Professional

Reference Text Books:			
	Author	**Title**	**Publisher**

1	Sachin Malhotra	Programming in Java	OXFORD University Press
2	John R, Hubbard	Programming with Java, Second Edition	Schaum's outline Series, TATA McGraw-Hill Company.
3	Deitel &Deitel.	Java TM: How to Program 2007	PHI
4	D.S Mallik	Java Programming: From Problem Analysis to Program Design	
5	P. Radha Krishna	Object Oriented Programming Through Java, 2008	Universities Press

Course Delivery method: Face-to-face / Blended

Course has focus on: Skill Development.

Recommended Co – Curricular Activities:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging).
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerised adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-III

COURSE 7: OBJECT ORIENTED PROGRAMMING

Practical Credits: 1 2 hrs/week

Course Objective:

The Objective of this course is to apply programming skills in java.

Course Outcomes: At the end of this course the student is able to

CO1: Overview of java programming**. (PO5,PO7)**

CO2: Understand fundamentals of programming such as variables, conditional and iterative execution, statements, etc**. (PO5,PO7)**

CO3: Understand the principles of arrays, inheritance, packages and multi-threading**. (PO5,PO7)**

CO4: Understand the Fundamental features of Exceptions and Applet Programming**. (PO5,PO7)**

CO5: Understand the Files concept in java**. (PO5,PO7)**

LAB LIST

1. Write a java program to print Hello World.
2. Write a java program on Variables.
3. Write a java program to use various Data types.
4. Write a java program to implement main method inside and outside of a class.
5. Write a java program on Operators.
6. Write a java program on Looping.
7. Write a java program to display Fibonacci series.
8. Write a java program to find out the given number is palindrome or not.
9. Write a java program on single and Multi-dimensional array.
10. Write a java program on Strings.
11. Write a java program on interface.
12. Write java programs on various types of Inheritance.
13. Write java programs on Packages.
14. Write a java program on Multi-Threading.
15. Write java programs on various types Exceptions.
16. Write an Applet program to draw a Line, Rectangle, Circle, Ellipse, Arcs a.
17. Write an Applet program to draw Line graphs and Bar charts.
18. Write a java program to create a file.
19. Write a java program to perform read data from a file.
20. Write a java program to perform write data from a file.

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SEMESTER-III

COURSE 8: INFERENTIAL STATISTICS

Theory Credits: 3 3 hrs/week

Course Objective:

This course enables students to gain knowledge in sampling, hypothesis testing and non parametric methods.

Course Outcomes:

After going through this course, the students will get

CO1: a fundamental understanding of Parametric models for developing relevant inferences on associated parameters,

CO2: knowledge of point and interval estimation procedures and different methods of point estimation,

CO3: using Neyman Pearson Lemma and finding Uniformly Most Powerful Test,

CO4:various basic concepts on sampling distributions and large sample tests based on normal distribution,

CO5 : small sample tests based on chi-square, Student's and Snedecor's F distributions

Unit I

Theory of Estimation: Parameter, Statistic, Standard Error of the statistic, concept of bias and mean square error of an estimate, Criteria of good estimator - unbiasedness, consistency, efficiency, and sufficiency. Methods of estimation- Maximum Likelihood estimator(MLE) and Method of Moments(MME).Concepts of confidence interval and confidence coefficient, confidence intervals for the parameters of univariate normal,

Unit II

Testing of Hypothesis : Statistical hypotheses, critical region, size and power of a test, most powerful test, two types of errors. Neyman Pearson lemma(WITHOUT PROOF) and its applications, uniformly most powerful unbiased test . One and two tailed tests. Procedure for testing of hypothesis, Tests of significance of large samples - Single proportion and difference of proportions, single mean and difference of means.

Unit III

Exact Sampling distributions : Student's t-distribution, Chi-square distribution, Snedecor's Fdistribution – definitions, properties and applications. Tests of significance for small samples: Student's t-distribution - single mean, difference of means and paired t-test. Chi-square distribution-test for goodness of fit and independence of attributes.

Unit IV

F-distribution – definition, properties and applications – F-test for equality of two population variances. ANOVA one way and two-way classifications

Unit V

Non-parametric methods- definition, advantages and disadvantages. One sample test- Sign test, Run test, Wilcoxon-signed rank test. Two independent sample tests: Median test, Wilcoxon- Mann Whitney U - test, Kruskal Wallis test - Simple Problems Note: Without proofs of named theorems and more importance to applications.

TEXT BOOK:

S.C. Gupta, (2019), Seventh Edition, Fundamentals of Statistics, Mumbai: Himalaya Publishing House.

REFERENCE BOOKS

1. Sharma, J. K. (2013), Business statistics, New Delhi: Pearson Education

2. Levine, D.M., Berenson, M. L. & Stephan, D. (2012), Statistics for managers using Microsoft Excel, New Delhi: Prentice Hall India Pvt.

3. Aczel, A. D. &Sounderpandian, J. (2011), Complete Business Statistics, New Delhi: Tata McGraw Hill.

4. Anderson, D., Sweeney, D., Williams, T., Camm, J., & Cochran, J. (2013), Statistics for Business and Economics, New Delhi: Cengage Learning.

5. Davis, G., &Pecar, B. (2014), Business Statistics using Excel, New Delhi: Oxford University Press.

Websites of Interest:

http://onlinestatbook.com/rvls/index.html

Co-Curricular Activities in the class:

1. Pictionary
2. Case Studies on topics in field of statistics
3. Snap test and Open Book test
4. Architectural – To be build the procedures
5. Extempore – Random concept to students
6. Interactive Sessions
7. Teaching through real world examples

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SEMESTER-III

COURSE 8: INFERENTIAL STATISTICS

Practical | Credits: 1 | 2 hrs/week

Course Objective:

This course enables students to gain hands-on practical experience of SPSS for analysing data by implementing sample tests, ANOVA and nonparametric tests..

Course Outcome:

Upon successful completion of this course, students should have the knowledge and skills to:

CO1: Apply the various statistical methods for real life problems PO2

CO2 Apply the SPSS techniques and give the interpretations. PO2

List of Practicals using SPSS

1. Large Sample Tests: Test of significance of (a) Single Mean (b) Difference of means

2. Large Sample Tests: Test of significance of (a) Single Proportion (b) Difference of Proportions

3. Small Sample Tests: t-Test for significance of (a) Single mean (b) Difference of means- samples are independent (c) Difference of means- samples are dependent

4. Chi square Test of (a) Independence 2x2 Cross tabulation, (b) Goodness of fit

5 Test for several means ANOVA (a) One-way (b) Two- way classification,

6 Non Parametric Tests (a) Mann Whitney U test, (b) Wilcoxon Signed ranks test, (c) Kruskal Wallis Test, (d) Friedman test Note: Training shall be in SPSS and derive the results. The SPSS output shall be exported to MS word for writing inference.

Reference Manual: Practical Manual -Prepared by the Department Faculty Members

Websites of Interest: http://www.statsci.org/datasets.html

Scheme of Valuation for Practical Paper (i) Continuous evaluation 10 Marks (ii) External Evaluation: 40 marks

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SEMESTER-IV

COURSE 9: DATA WAREHOUSING AND DATA MINING

Theory Credits: 3 3 hrs/week

OBJECTIVE:

The course should enable the students to learn principles of Data warehousing and data mining with its architecture and understand data preprocessing methods to perform classification and prediction of data. Technical knowledge is helpful to implement Data Mining principles and techniques for real time applications.

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	To understand the principles of Data warehousing and Data Mining.	PO1, PSO1, PSO2, PSO4
2	To be familiar with the Data warehouse architecture and its Implementation.	PO1, PSO1, PSO2, PSO4
3	To know the Architecture of a Data Mining system.	PO1, PSO1, PSO2, PSO4
4	To understand the various Data preprocessing Methods.	PO1, PO7, PSO1, PSO2, PSO4
5	To perform classification and prediction of data.	PO1, PO7, PSO1, PSO2, PSO4

UNIT I

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

UNIT II

Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

UNIT III

Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Backpropagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

UNIT IV

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

UNIT V

Mining Object, Spatial, Multimedia, Text and Web Data:
Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.Text Book

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

Reference Books

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual andchallenging)
2. Student seminars (on topics of the syllabus and related aspects (individualactivity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups asteams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-IV

COURSE 9: DATA WAREHOUSING AND DATA MINING

Practical Credits: 1 2 hrs/week

Course Objectives:

This course enables students to practically implement various data mining techniques.

Course Outcomes:

By the end of this course, students will be able to

CO1: implement data files conversions and can train, test data sets for an application. (PO5, PO7)

CO2: generate accurate models, and demonstrate data pre - processing. (PO5, PO7)

CO3: Demonstrate text mining and web mining techniques. (PO4, PO7)

LAB EXPERIMENTS:

- □ List applications for mining
- □ File format for data mining
- □ Conversion of various data files
- □ Training the given dataset for an application
- □ Testing the given dataset for an application
- □ Generating accurate models
- □ Data pre-processing – data filters
- □ Feature selection
- □ Web mining
- □ Text mining
- □ Design of fact & dimension tables
- □ Generating graphs for star schema

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SEMESTER-IV

COURSE 10: MACHINE LEARNING USING PYTHON

Theory Credits: 3 3 hrs/week

OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified

Course Outcomes :

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

CO1: Explain the basic concepts of machine learning.

CO2 : Construct supervised learning models.

CO3 : Construct unsupervised learning algorithms.

CO4: Evaluate and compare different models

UNIT I INTRODUCTION TO MACHINE LEARNING

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from

shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, ~~2012~~, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019.

Recommended Co – Curricular Activities:

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

1. Programming exercises,
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Individual and group project reports.
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.
7. Computerized adaptive testing, literature surveys and evaluations,
8. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-IV

COURSE 10: MACHINE LEARNING USING PYTHON

Practical | Credits: 1 | 2 hrs/week

OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified

Course Outcomes :

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

CO1: Explain the basic concepts of machine learning.

CO2 : Construct supervised learning models.

CO3 : Construct unsupervised learning algorithms.

CO4: Evaluate and compare different models

EXPERIMENT LIST:

1. Write a python program to import and export data using Pandas library functions.
2. Demonstrate various data pre-processing techniques for a given dataset
3. Implement Dimensionality reduction using Principle Component Analysis (PCA) method.
4. Write a Python program to demonstrate various Data Visualization Techniques.
5. Implement Simple and Multiple Linear Regression Models.
6. Develop Logistic Regression Model for a given dataset.
7. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
8. Implement Naïve Bayes Classification in Python.
9. Build KNN Classification model for a given dataset.
10. Build Artificial Neural Network model with back propagation on a given dataset.
    a. Implement Random forest ensemble method on a given dataset.
    b. Implement Boosting ensemble method on a given dataset.
11. Write a python program to implement K-Means clustering Algorithm.

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SEMESTER-IV

COURSE 11: INTRODUCTION TO AI

Theory Credits: 3 3 hrs/week

Course Objective:

The objective of this course is to educate students in basic Artificial Intelligence concepts and provide insights of solving problems using AI. This course also aims to educate students in basics of practical natural language processing and robotics.

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	**PROGRAM OUTCOME NO**
CO1	Understand the need of AI and Intelligent Agents.	PO5, PO7
CO_2	Understand knowledge based agents and prepositional logic.	PO5, PO7
CO_3	Gain knowledge about learning agents and decision trees.	PO5, PO7
CO_4	Gain knowledge about practical applications of NLP.	PO5, PO7
CO_5	Understand parts, tasks and architecture of Robotics.	PO5, PO7

UNIT – I:

Introduction to AI: What is AI? AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-II:

Searching: Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A*, AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT-III:

Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempstershafer theory.

UNIT-IV

First order logic: Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT-V:

Expert systems:- Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, knowledge engineering, scope of knowledge, difficulties in knowledge acquisition methods of machine learning, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation & meta knowledge inference with uncertainty.

TEXT BOOKS

Stuart Russell, Peter Norvig: "Artificial Intelligence: A Modern Approach",2nd Edition, Pearson Education, 2007

REFERENCES

1. Artificial Neural Networks B. Yagna Narayana, PHI
2. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).
3. Artificial Intelligence and Expert Systems – Patterson PHI.
4. Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson.
5. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.
6. Neural Networks Simon Haykin PHI

Web Resources:

https://www.javatpoint.com/artificial-intelligence-ai

https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_overview.html

https://www.academia.edu/32098490/Introduction_to_artificial_intelligence

Recommended Co – Curricular Activities:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A: Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B: General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-IV

COURSE 11: INTRODUCTION TO AI

Practical Credits: 1 2 hrs/week

Course Objective:

The objective of this course is to enable students to analyse various AI related problems and develop a solution using Python programming language.

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO1	Develop various basic python programs.	PO5, PO7
CO_2	Analyse and develop solutions for various problems like water jug, Tic – Tack – Toe, etc.	PO5, PO7
CO_3	Develop programs using DFS, BFS, A* and hill climbing algorithms.	PO5, PO7
CO_4	Develop python programs for analysing given data set.	PO5, PO7
CO_5	Develop python programs for implementing Bayes Classification.	PO5, PO7

Lab List

1. A) Basic programs in python.
   B) Programs demonstrating list, Vector, Matrix and Array
2. Solving water – jug problem using Python.
3. Implementing DFS and BFS using Python.
4. Solve 8 – puzzle problem using A* algorithm.
5. Solve 8 – puzzle problem using hill climbing Algorithm.
6. Implement Tic – Tac – Toe game using Python.
7. Develop Python code for mini – max algorithm.
8. Develop Python code for Hangman game.
9. A) Develop Python code for removing punctuation marks from the given string.
   B) Develop Python code for sorting the sentence in alphabetical order.
10. A) Using Pylog programming, display first order logic.
    B) Using Pylog programming, display unification process.
11. A) Find mean and mode for given data set.
    B) Calculate variance and standard deviation for given data set.
12. A) Determining probability of a prime number appearing when a 20 sided die is rolled.
    B) Time series analysis to predict rain fall information base on record.
13. Predict the class of testing sample using Bayes Classification.

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SEMESTER-V

COURSE 12: PREDICTIVE ANALYTICS USING PYTHON

Theory Credits: 3 3 hrs/week

Course Objectives:

The course serves to advance and refine expertise on theories, approaches and techniques related to prediction and forecasting.

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Understand prediction-related principles, theories and approaches.	PO6
2	Learn model assessment and validation.	PO6
3	Understand the basics of predictive techniques and statistical approaches.	PO6
4	Understand basics of neural networks	PO6
5	Analyse supervised and unsupervised algorithms.	PO6

UNIT - I Introduction to Linear Regression .

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Lasso regression, Linear Discriminant Analysis, Logistic regression, Perceptron learning algorithm.

UNIT - II Model Assessment and Selection

Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Bootstrap methods, conditional or expected test error.

UNIT - III Additive Models, Trees and Boosting

Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Examples (Spam data, California housing, New Zealand fish, Demographic data).

UNIT - IV Introduction to NN

Neural Networks (NN), Support Vector Machines (SVM), and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest – Neighbour classifiers (Image Scene Classification).

UNIT - V Unsupervised and Supervised Learning

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

TEXT BOOK:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

REFERENCE BOOKS:

1. C.M.Bishop –Pattern Recognition and Machine Learning, Springer, 2006.

2. L. Wasserman-All of statistics.

3. Gareth James. Daniela Witten. Trevor Hastie Robert Tibshirani. An Introduction to Statistical Learning with Applications in R.

Recommended Co – Curricular Activities:
(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging).
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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:
Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerised adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-V

COURSE 12: PREDICTIVE ANALYTICS USING PYTHON

Practical Credits: 1 2 hrs/week

Course Objectives:

The course serves to advance and refine expertise on practical approaches and techniques related to prediction and forecasting.

Course Outcomes :

By the end of course, students will be able to

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Implement various logistics regression algorithms	PO6
2	Implement numerical optimization and test errors	PO6
3	Implement K - Nearest algorithms	PO6
4	Implement Random forests analysis	PO6

LAB CYCLE

1. Demonstrating logistic regression.
2. Demonstrating perceptron learning algorithm.
3. Demonstrating Bayesian model.
4. Demonstrating numerical optimization.
5. Demonstrating classification trees.
6. Demonstrating regression analysis.
7. Demonstrating L - nearest neighbour.
8. Demonstrating back propagation.
9. Demonstrating SVM for regression analysis.
10. Demonstrating random forests and analysis.

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SEMESTER-V

COURSE 13: ALGORITHMS FOR INTELLIGENT SYSTEMS

Theory Credits: 3 3 hrs/week

OBJECTIVE:

The course should enable the students to focus on developing machine that can think which leads to gain fundamental knowledge for understanding AI. these topics are closely related with each other. For example, the knowledge acquired through learning can be used both for problem solving and for reasoning. In fact, the skill for problem solving itself should be acquired through learning. Also, methods for problem solving are useful both for reasoning and planning. Further, both natural language understanding and computer vision can be solved using methods developed in the field of pattern recognition.

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Understanding the foundations of Artificial Intelligence	PO1, PSO1, PSO2, PSO4
2	Representing a problem as a search solving problem.	PO1, PSO1, PSO2, PSO4
3	Searching a space of answers for a solution to a problem in practical time.	PO1, PSO1, PSO2, PSO4
4	Representing problems in terms of logic and deduction.	PO1, PO7, PSO1, PSO2, PSO4
5	Representing intelligent behavior in terms of agent.	PO1, PO7, PSO1, PSO2, PSO4

Introduction and History of AI: What is AI ? A brief history ? The state of the art

Intelligent Agents: Agents and environments, Rationality, PEAS (Performance measure, Environment, Actuators, Sensors), Environment types, Agent types

Solving Problem by Searching: Problem-solving agents, Problem types, Problem formulation, Example problems, Basic search algorithms

Informed search algorithms: Best-first search, A*_ search, Heuristics

Adversial Search: Games, Perfect play, minimax decisions, pruning, Resource limits and approximate evaluation, Games of chance, Games of imperfect information

Reference Text Book:

Title: Artificial Intelligence: A Modern Approach, Author(s):Stuart Russell and Peter Norvig, Edition:3rd Edition, Publisher:Prentice-Hall.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
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B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-V

COURSE 13: ALGORITHMS FOR INTELLIGENT SYSTEMS

Practical | Credits: 1 | 2 hrs/week

Course Objective:

The objective of this course is to enable students to develop and implement algorithms for problem solving using AI.

Course Outcome:
By the end of this course, student will be able to
CO1 : understand PROLOG (PO5, PO7)
CO2 : Develop algorithms for solving logical problems. (PO5, PO7)

LAB EXPERIMENTS:

- □ Study of PROLOG
- □ Write the following programs using PROLOG:
- □ Write a program to solve 8-queens problem.
- □ Solve any problem using depth first search.
- □ Solve any problem using best first search.
- □ Solve 8-puzzle problem using best first search
- □ Solve Robot (traversal) problem using means End Analysis.
- □ Solve the Traveling Salesman problem.

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SEMESTER-V

COURSE 14: NATURAL LANGUAGE PROCESSING

Theory Credits: 3 3 hrs/week

Course Objective:

A Given text with basic Language features and to design an innovative application using NLP components to implement a rule-based system to tackle morphology/syntax of a language

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	**PROGRAM OUTCOME NO**
CO1	To understand the use of CFG and PCFG in NLP	PO5,P07
$CO2_2$	To learn control structures in python and apply them to real world problems.	PO5,P07
$CO3_3$	To understand the role of semantics of sentences and pragmatics	PO5,P07
$CO4_4$	To apply the NLP techniques to IR applications	PO5,P07
$CO5_5$	To construct data and perform data analysis.	PO5,P07

UNIT I INTRODUCTION

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009.

REFERENCES

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java‖, O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.

Recommended Co – Curricular Activities:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

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B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-V

COURSE 14: NATURAL LANGUAGE PROCESSING

Practical Credits: 3 3 hrs/week

Course Objective:

The main objective of this course is to enable students to enhance their Knowledge on basic Language processing features, design an innovative application using NLP components

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	**PROGRAM OUTCOME NO**
CO1	Apply basic principles of AI in solutions that require problem solving, knowledge representation,	PO5,P07
CO2	Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.	PO5,P07
CO3	Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems	PO5,P07
CO4	Able to design, implement	PO5,P07
CO5	Analyze NLP algorithm	PO5,P07

Experiments List

1) Write a program in prolog to implement simple facts and Queries
2) Write a program in prolog to implement simple arithmetic
3) Write a program in prolog to solve Monkey banana problem
4) Write a program in prolog to solve Tower of Hanoi
5) Write a program in prolog to solve 8 Puzzle problems
6) Write a program in prolog to solve 4-Queens problem
7) Write a program in prolog to solve Traveling salesman problem
8) Write a program in prolog for Water jug problem List of Experiments (NLP) 1. Word Analysis 2. Word Generation 3. Morphology 4. N-Grams 5. N-Grams Smoothing

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SEMESTER-V

COURSE 15: SOFTWARE PROJECT MANAGEMENT

Theory Credits: 3 3 hrs/week

Course Objectives:

- To understand the fundamental principles of software project management.
- To have a good knowledge of responsibilities of project manager.
- To be familiar with the different methods and techniques used for project management.

COURSE OUTCOMES:

CO1	**Evaluate** and decide the software project management. (PO5, PO7)
CO2	**Determine and classify** the project life cycle and estimate the effort of Agile methods.(PO5, PO7)
CO3	**Formulate** the project activity plan and project risk management (PO5, PO7)
CO4	**Organize** and **manage** the project contracts. (PO5, PO7)
CO5	**Establishing** the staffing pattern and Document the organizational behavior. (PO5, PO7)

UNIT - I

PROJECT EVALUATION AND PROJECT PLANNING

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT - II

PROJECT LIFE CYCLE AND EFFORT ESTIMATION:

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques –COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

UNIT - III

ACTIVITY PLANNING AND RISK MANAGEMENT:

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling –Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method– Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation –Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT - IV

PROJECT MANAGEMENT AND CONTROL:

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control, Software Configuration Management – Managing contracts – Contract Management.

UNIT - V

STAFFING IN SOFTWARE PROJECTS:

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres –Communication plans

TEXT BOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.

2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.

3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education

(India), Fourteenth Reprint 2013.

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SEMESTER-V

COURSE 15: SOFTWARE PROJECT MANAGEMENT

Practical Credits: 1 2 hrs/week

Course Objective:

The objective of this course is to enable students to practically implement various methods and techniques for software project management using python.

Course Outcome:

Course Outcome	By the end of the course, students will be able to	Programme Outcome
CO1	implement function point analysis and models like flexi and SEL.	PO5, PO7
CO2	implement basic, intermediate and detailed COCOMO.	PO5, PO7

LAB LIST

1. Demonstrate function point analysis.
2. Demonstrate flexi model.
3. Demonstrate SEL model.
4. Demonstrate basic COCOMO.
5. Demonstrate intermediate COCOMO.
6. Demonstrate detailed COCOMO.
7. Demonstrate early design model and calculate effort for development of project.

Ref: Software Project Management -Lab file - LABORATORY FILE Software Project Management (SE-405) 2021 - Studocu

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SEMESTER-VII

COURSE 16: DEEP LEARNING

Theory Credits: 3 3 hrs/week

OBJECTIVES:

- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Understand the role of Deep learning in Machine Learning Applications.	PO6
2	To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.	PO6
3	To design and implement Deep Learning Applications.	PO6
4	Critically Analyse Different Deep Learning Models in Image Related Projects.	PO6
5	To design and implement Convolutional Neural Networks.	PO6

UNIT I BASICS OF NEURAL NETWORKS

Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

UNIT II INTRODUCTION TO DEEP LEARNING

Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.

UNIT III CONVOLUTIONAL NEURAL NETWORKS

CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

UNIT IV MORE DEEP LEARNING ARCHITECTURES

LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Auto encoders – Adversarial Generative Networks – Autoencoder and DBM

UNIT V APPLICATIONS OF DEEP LEARNING

Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision – Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

TEXT BOOK:

1. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

REFERENCES:

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress , 2017.
3. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
4. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
5. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

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RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual andchallenging)
2. Student seminars (on topics of the syllabus and related aspects (individualactivity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups asteams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-VII

COURSE 16: DEEP LEARNING

Practical Credits: 1 2 hrs/week

OBJECTIVES:

- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Understand the role of Deep learning in Machine Learning Applications.	PO6
2	To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.	PO6
3	To design and implement Deep Learning Applications.	PO6
4	Critically Analyse Different Deep Learning Models in Image Related Projects.	PO6
5	To design and implement Convolutional Neural Networks.	PO6

Experiments List

Week-1 : Perceptron Learning Implementation
Week-2 : Multilayer Perceptron and its Hyperparameter Tuning
Week-3 : Hyperparameter Tuning
Week-4 : Implementation of Multilayer Neural Network using Keras and Data Augmentation on MNIST dataset.
Week-5 : CNN Implementation on MNIST Dataset.
Week-6 : Transfer Learning of pretrained models on MNIST dataset
Week-7 : Transfer Learning on Plant Village dataset for Plant Disease Detection
Week-8 : Sentiment Analysis using Recurrent Neural Networks(RNN)
Week-9 : Text Generation using LSTM
Week-10 : Denoising and Dimensionality Reduction for Medical MNIST dataset using Autoencoders

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SEMESTER-VII

COURSE 17: TEXT MINING

Theory Credits: 3 3 hrs/week

Objectives:

To understand the principles, issues with text mining.

To understand techniques and solutions connected with text mining,

To understand the Fundamentals of natural language processing.

Course out comes

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO1	To Understand the enhancing user experience of information provision and seeking, the business case for text mining.	Po5,po7
CO2	To Understand The text mining pipeline	Po5,po7
CO3	To Understand Approaches to text mining	Po5,po7
CO4	To Understand Dealing with real text and Information extraction	Po5,po7
CO5	To Understand Evaluation of text mining systems	Po5,po7

Unit -1

Introduction: background, motivation, dealing with information overload and information overlook, unstructured vs. (semi-)structured data, evolving information needs and knowledge management issues, enhancing user experience of information provision and seeking the business case for text mining.

Unit -2

The text mining pipeline: information retrieval, information extraction and data mining.
Fundamentals of natural language processing: linguistic foundations, levels of linguistic analysis.

Unit- 3

Approaches to text mining: rule-based vs. machine learning based vs. hybrid; generic vs. domain specific; domain adaptation.

Unit -4

Dealing with real text: text types, document formats and conversion, character encodings, markup, low-level processes (sentence splitting, tokenisation, part of speech tagging, chunking)

Information extraction: term extraction, named entity recognition, relation extraction, fact and event extraction; partial analysis vs. full analysis.

Data mining and visualisation of results from text mining.

Unit -5

Evaluation of text mining systems: evaluation measures, role of evaluation challenges, usability evaluation.

Resources for text mining: annotated corpora, computational lexica, ontologies, computational grammars; design, construction and use issues.

Issues in large scale processing of text: distributed text mining, scalable text mining systems.

TEXT BOOKS

The text mining handbook : BY advanced approaches in analyzing unstructured data BY	Feldman, Ronen, 1962-	PUBLISHER	Cambridge University Press
Linked lexical knowledge bases : foundations and applications BY	Gurevych, Iryna, author. 1	PUBLISHER	Morgan & Claypool Publishers
Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition	Jurafsky, Dan, 1962-	PUBLISHER	Pearson/Prentice Hall

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual andchallenging)
2. Student seminars (on topics of the syllabus and related aspects (individualactivity))
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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion

2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-VII

COURSE 17: TEXT MINING

Practical Credits: 1 2 hrs/week

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO1	To extract tokens, Vocabular and , Punctuation	P07
CO2	To extract Part of speech Root of a word	P07
CO3	To exract Base of a word stop words using distributions	P07
CO4	To demonstate Operations on Text	P07
O5	To implement parts of speech tagging Searching strings	P07

LAB LIST

programs for various elements of textual data and see how we can extract these using the NLTK library.

Hierarchy of Text

1. Tokens
2. Vocabulary
3. Punctuation
4. Part of speech
5. Root of a word
6. Base of a word
7. Stop words using distributions
8. Operations on Text
9. Parts of speech tagging
10. Searching strings

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SEMESTER-VII

COURSE 18: COMPUTER NETWORKS

Theory Credits: 3 3 hrs/week

Course Prerequisites (if any): Basic knowledge of Java, search algorithms.

Course Description:
It explores the architecture, components and protocols, of computer networks. Students learn how various network protocols run concurrently and interoperate together in the protocol stack to enable the transfer of data in the Internet.

Objectives:
1. To educate students on fundamental concepts of data communication and the design of computer networks.
2. To educate student on basic aspects of data link layer.
3. To educate student on datagram routing algorithm and shortest path routing algorithm. 4. To educate student on elements of transport layer protocol.
5. To educate student on fundamental concepts of application layer.

Course Outcomes: At the end of this course, students should be able to:
CO1: gain knowledge in the need of OSI reference model and various types of transmission media, switching techniques. (PO5, PO7).
CO2: gain knowledge in data link protocols, error detection and correction.(PO5, PO7). CO3: gain knowledge regarding design issues of network layer and can implement shortest path algorithm.(PO5, PO7).
CO4: gain knowledge in elements of transport layer protocols.(PO5, PO7)
CO5: gain knowledge in domain name system, WWW architecture and Email architecture and services.PO5, PO7).

UNIT I: Introduction to Networking
Uses of computer networks, Types of computer networks, ISO OSI reference model, Multiplexing - Frequency Division Multiplexing, Wave Length Division Multiplexing, Time Division Multiplexing; Guided media - Twisted pair cable, Coaxial cable, Fibre optics; Unguided media - Radio waves, Micro waves, Satellites; Switching - Circuit switching, Packet switching, Message switching.

UNIT II: Data Link Layer
Design issues of data link layer, Data link protocols - unrestricted simplex protocol, simplex stop and wait protocol, one bit sliding window protocol; Bluetooth, Error detection and correction

UNIT III: Network Layer Introduction,
Design issues of network layer, Virtual vs Datagram routing algorithms, Shortest pathrouting algorithm, Flooding, Distance vector routing algorithm, Congestion control algorithms.

UNIT IV: Transport Layer Introduction,
Design issues of Transport Layer, Elements of Transport Protocols, Addressing - Connection Establishment, Connection Release, Flow control and Buffering, Multiplexing, Crash Recovery; Remote Procedure Call, User Datagram Protocol, Transmission Control Protocol

UNIT V: Application Layer
Domain Name system, Email architecture and services, User agent sending and receiving Email, WWW Architectural Overview, Client side Server side URL, Cookies, Cryptography

Text book:

1. Computer Networks-Andrew.S.Tanenbaum, Pearson Edu Asia Fourth edition. 2. Introduction to Data Communications and Networking-Behrouz Forouzan,Tata McGraw Hill Edition

Course Delivery method: Face-to-face / Blended

Course has focus on: Employability

Websites of Interest:

1. https://www.javatpoint.com/java-tutorial
2. https://www.w3schools.com/java/
3. https://www.tutorialspoint.com/jdbc/index.htm

Co-curricular Activities: Programming Contests, Assignments & Quiz.

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SEMESTER-VII

COURSE 18: COMPUTER NETWORKS

Practical Credits: 1 2 hrs/week

Course Prerequisites (if any): Knowledge in Java and computer network protocols.

Course Objective:
To enable students to implement various computer network protocols using the Java programming language.

Course Outcomes: At the end of this course, students should be able to:

CO1: Implement various protocols like stop and wait, sliding window and ARP protocols. (PO5, PO7)
CO2: Implement PING, TRACE OUT commands and create HTTP sockets. (PO5, PO7)
CO3: Implement TCP and UDP sockets. (PO5, PO7)

Lab List

1. Implementation of Stop and Wait Protocol

2. Implementation of Sliding Window Protocol

3. Study of Socket Programming and Client – Server model

4. Write a code simulating ARP /RARP protocols.

5. Write a code simulating PING and TRACEROUTE commands

6. Create a socket for HTTP for web page upload and download.

7. Write a program to implement RPC (Remote Procedure Call).

8. Implementation of Subnetting.

9. Applications using TCP and UDP Sockets like DNS, SNMP and File Transfer

10. Applications using TCP Sockets like
A) Echo client and echo server B) Chat C) File Transfer

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SEMESTER-VIII

COURSE 21: NEURAL NETWORKS

Theory Credits: 3 3 hrs/week

Course Objective:

The main objective of this course is to provide the student with the basic understanding of neural networks fundamentals, Program the related algorithms and Design the required and related systems

Course Outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO_1	Demonstrate ANN structure and activation Functions	PO5, PO7
CO_2	Define foundations and learning mechanisms and state-space concepts	PO5, PO7
CO_3	Identify structure and learning of perceptions.	PO5, PO7
CO_4	Explain Feed forward, multi-layer feed forward networks and Back propagation algorithms	PO5, PO7
CO5	Analyze Radial Basis Function Networks, Theory Regularization and RBF networks fuzzy systems.	PO5, PO7

UNIT I:

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT II:

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT III:

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT IV:
Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.

UNIT V:
Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm
Hopfield Models – Hopfield Models, restricted boltzmen machine.

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.

2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

Reference Books:

Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

Student Activity:

1. Load any new operating system into your computer.
2. Partition the memory in your system
3. Create a semaphore for process synchronization.

Recommended Co – Curricular Activities:

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

1. Programming exercises,
2. Practical assignments and laboratory reports,
3. Observation of practical skills,
4. Individual and group project reports.
5. Efficient delivery using seminar presentations,
6. Viva voce interviews.
7. Computerized adaptive testing, literature surveys and evaluations,
8. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-VIII

COURSE 21: NEURAL NETWORKS

Practical Credits: 1 2 hrs/week

Course objectives:
To gain knowledge in various fundamental concepts of Artificial Neural Networks which will help students to get sufficient knowledge to Analyze and design the various intelligent control systems.

Course outcomes:

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO_1	Understand the characteristics and types of artificial neural network and remember working of biological Neuron and Artificial Neural Network	PO5, PO7
CO_2	Apply learning algorithms on perceptron and apply back propagation learning on Neural Network.	PO5, PO7
CO_3	Apply Back propagation algorithms application.	PO5, PO7
CO_4	Design Convolutional Neural Network and classification using Convolutional Neural Network.	PO5, PO7
CO5	Solve sequence learning problem and implement long short term memory and gated recurrent.	PO5, PO7

Lab Experiments:

Week 1:
Write a program to implement Perceptron.

Week 2:
Write a program to implement AND gates.

Week 3:
Write a program to implement OR gates.

Week 4:

Implement Crab Classification using pattern net.

Week 5:

Write a program to implement Wine Classification using Back propagation.

Week 6:

Write a Script Addition function.

Week 7:

Write a Script Subtraction function.

Week 8:

Write a Script Multiply function.

Week 9:

Write a Script Divide function.

Week 10:

Write a program to implement classification of linearly separable Data with a perceptron.

Week 11:

Implement single layer neural network classification.

Week 12:

Implement multi-layer neural network classification

Week 13:

Implement Regression.

Week 14:

To study Convolutional Neural Network and Recurrent Neural Network.

Week 15:

To study ImageNet, GoogleNet, ResNet convolutional Neural Networks.

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SEMESTER-VIII

COURSE 22: DESIGN THINKING

Theory Credits: 3 3 hrs/week

Course Objectives

To solve problems using Design Thinking and to radically increase likelihood of success by using Design Thinking.

Course Outcomes:

Course Outcome No	Upon successful completion of the course, student will be able to:	Program Outcome No
CO1	Learn what is design thinking and when to use it.	PO5
CO2	Understand principles of Design Thinking.	PO5
CO3	Understand process of Design thinking.	PO5
CO4	Develop application using design thinking .	PO5,PO7
CO5	Apply Design thinking to real world scenarios.	PO5,PO7

UNIT – I:

Introduction to Design thinking: History of design thinking, where design thinking is used, why design thinking is effective, how it works, What is design thinking ?, thinking vs doing, how design thinking supports delivering products?, the roots of design thinking, myth busting design thinking.

UNIT – II:

Core Principles of Design Thinking: Principle1-users over stake holders-user research basics-observations, interviews, co-creation, concept reviews, existing research, known problems, how might we statements, acceptance criteria.Principle 2-practical creativity-getting people to be impractical,getting from impractical to practical.Principle 3-making through learning.

UNIT – III:

Design thinking process: Think about content to be included,state the need being solved, the process that led to defining the problem, the ideation phase,getting feed back from your coworkers, presenting the prototype and testing results.Empathize, define, ideate, prototype , Test.

UNIT – IV:

Applying design thinking process:

ACNE breakfast center use case:who are users, what are their pain points, developing how might we solve statements, developing acceptance criteria.putting users in context-busy professionals,picky and particulars, frenetic families.Identifying user needs, key behavior , their problems and framing new

solutions or ideas.Ideas evaluation, ranking of ideas, identifying best idea to solve the problem.

UNIT – V:
Application of Design Thinking to real world scnearios:

Case 1:Developers creating a banking app with an easier to navigate UI than current competitors,case 2:teachers releasing new online course based on previous student experiences.

BOOKS:

- What is Design Thinking? By Julie Stanford, Ellen Siminoff & Mia Silverman, O'Reilly
- Design thinking 101 by Gretchen Anderson ,O'Reilly(course)
- Web references: https://slidemodel.com/how-to-present-design-thinking-process/#header-4

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual andchallenging)
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3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups asteams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,

6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-VIII

COURSE 22: DESIGN THINKING

Practical Credits: 1 2 hrs/week

COURSE OUTCOME NO	Upon successful completion of this course, students should have the knowledge and skills to:	PROGRAM OUTCOME NO
CO1	Understand process of Design thinking.	PO5

CO2	Develop application using design thinking .	PO5,PO7
CO3	Apply Design thinking to real world scenarios.	PO5,PO7

Lab Experiments List

1. Developers creating a banking app with an easier-to-navigate UI than current competitors
2. Teachers releasing a new online course based on previous student experiences
3. To improve business of start up company Air bed and breakfast.
4. Redesigning the Customer Contact Center at Toyota
5. GE Adventure MRI

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SEMESTER-VIII

COURSE 23: ROBOTICS AND INTELLIGENT SYSTEMS

Theory Credits: 3 3 hrs/week

OBJECTIVE:

The course should enable the students to learn The fundamental concepts of various configurations of the robot manipulators and their working principles used in the industries along with The performance of various feedback components like sensors and actuators and how they can be used according to the specifications of the manipulator.

Course Outcomes :

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Outline the relationship between mechanical structures of industrial robots and their operational workspace characteristics.	PO5, PO7
2	Demonstrate an ability to apply spatial transformation to obtain forward kinematics equations of robot manipulators and develop the mechanism for solving forward and inverse kinematics of simple robot manipulators.	PO5, PO7
3	Develop an ability to obtain the Jacobian matrix and use it to identify singularities.	PO5, PO7
4	Outline the various motions of the manipulator and use it for trajectory and also explain an ability to generate the trajectory for given application of robot manipulator and Identify the knowledge of robot controllers and actuators used in the manipulators.	PO5, PO7
5	Recall the applications of robots in manufacturing, material handling, assembly and inspections and Illustrate the considerations of workspace for a given robot application.	PO5, PO7

UNIT -I INTRODUCTION TO ROBOTICS

Introduction: Automation and robotics, an overview of robotics, classification by coordinate system and control systems, components of the industrial robotics: Degrees of freedom, end effectors: mechanical gripper, magnetic vacuum cup and other types of grippers, general consideration on gripper selection and design.

UNIT -II MOTION ANALYSIS AND KINEMATICS

Motion analysis: Basic rotation matrices, composite rotation matrices, equivalent angle and axis homogeneous transformation, problems; Manipulator kinematics: D-H notations, joint coordinates and world coordinates, forward and inverse kinematics, problems.

UNIT -III KINEMATICS AND DYNAMICS

Differential kinematics: Differential kinematics of planar and spherical manipulators, Jacobians problems. Robot dynamics: Lagrange, Euler formulations, Newton-Euler formulations, problems on planar two link manipulators.

UNIT -IV TRAJECTORY PLANNING AND ACTUATORS

Trajectory planning: Joint space scheme, cubic polynomial fit, avoidance of obstacles, types of motion: Slew motion, joint interpolated motion, straight line motion, problems, robot actuators and feedback components; actuators: pneumatic and hydraulic actuators.

UNIT -V ELECTRIC ACTUATORS AND ROBOTIC APPLICATIONS

Electric actuators: DC servo motors, stepper motors, feedback components: position sensors, potentiometers, resolvers and encoders, velocity sensors, tactile sensors; Robot application in manufacturing: Material handling, assembly and inspection.

Text Books:

1 Groover M. P, "Industrial Robotics", Tata McGraw-Hill, 1st Edition, 2013.

2 J.J Criag, "Introduction to Robotic Mechanics and Control", Pearson, 3rd Edition, 2013.

Reference Books:

1. K.S Fu, "Robotics", McGraw-Hill, 1st Edition, 2013

2. Richard, D. Klafter, "Robotic Engineering", Prentice Hall, 1st Edition, 2013.

Web Reference:

1. https://www.doc.ic.ac.uk/~ajd/Robotics/RoboticsResources/lecture1.pdf

2. http://opencourses.emu.edu.tr/course/view.php?id=32

3. https://www.researchgate.net/publication/277712686_Introduction_to_Robotics_class_notes_UG_level

E-Book:

1. http://www.robot.bmstu.ru/

2. http://www.robotee.com/index.php/download-free-robotic-e-books/

Recommended Co – Curricular Activities:
(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerised adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work.

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SEMESTER-VIII

COURSE 23: ROBOTICS AND INTELLIGENT SYSTEMS

Practical Credits: 1 2 hrs/week

Course Objectives:

The course serves to practically implement fundamental robotic concepts like manipulators, sensors, etc.

Course Outcomes :

By the end of course, students will be able to

CO. NO.	Upon successful completion of this course, students should have the knowledge and skills to	PO. No.
1	Demonstrate Rhino robot arm configurations.	PO6
2	Implement numerical optimization and test errors	PO6
3	Implement K - Nearest algorithms	PO6
4	Implement Random forests analysis	PO6

LAB CYCLE

1. Develop a CPP programme to demonstrate classes and constructors.
2. Develop a CPP programme to demonstrate user defined functions.
3. Develop a Rhino robotic arm and perform following operations:
    A) Move the Rhino using the teach pendant.
    B) Send the Rhino to the hard home and soft home configurations.
    C) Store sequences of encoders count as “programs” .
    D) Demonstrate a sequence of motions that, at minimum,places one block on top of another.
4. Demonstrate Rhino robot arm in CPP to solve towers of hanoi.
5. Demonstrate forward kinematics problem with a physical implementation on the Rhion robot.
6. Demonstrate inverse kinematics problem for Rhino robot arm and use CPP function to move the arm to space specified by the user.

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