# ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

**Programme:** B.Sc. Honours in Artificial Intelligence (Major)

**w.e.f. AY 2023-24**

**COURSE STRUCTURE**

<table>
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<tr>
<th>Year</th>
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Course Objective:

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

Learning outcomes:

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

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

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

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

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

UNIT I: ESSENTIALS OF MATHEMATICS:

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

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles

Vectors: Definition of vector addition – Cartesian form – Scalar and vector product 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 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:

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

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

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

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

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping

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

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

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

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results. After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2: Periodic Table Exploration

Provide students with a copy of the periodic table.

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

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

4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.
Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.
They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.
Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.
Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.
Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

4: Mathematical Modeling

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

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of your college network) and prepare a report covering network architecture.

2. 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, PHYSICAL AND CHEMICAL SCIENCES

Course Objective:

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

Learning outcomes:

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

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

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

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

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

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

UNIT I: ADVANCES IN BASICS MATHEMATICS

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

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

Integration: Integration as a reverse process of differentiation – Basic methods of integration
Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

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

UNIT III: ADVANCES IN CHEMISTRY:

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

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids,
Application of nanotechnology: Nanomedicine,
Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysiology,
Application of medical physics: Radiation Therapy, Nuclear medicine


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:
2. Calculus by Thomas and Finny, Pearson Publications
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
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

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

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

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

2: Limits and Differentiation Problem Solving
Students will apply the concept of limits to solve various problems using standard limits.

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

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

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

4: Matrices Manipulation
Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

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

UNIT II: ADVANCES IN PHYSICS:

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

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.

2: Experimental Design
Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

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

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

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

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

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

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

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

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

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

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants 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 with chemical pollutants. For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater. Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

3: Group Project

Assign students to work in groups to develop a project related to one of the topics. The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems. Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations. Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

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

2: Case Studies and Group Discussions

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

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

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

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

UNIT V: Advanced Applications of computer Science

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

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:

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<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
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<tr>
<td>CO1</td>
<td>To Understand Features and basic concepts of python.</td>
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<td>CO2</td>
<td>To learn control structures in python and apply them to real world problems.</td>
<td>PO5, PO7</td>
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<td>CO3</td>
<td>To implement functions and modules in python.</td>
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<tr>
<td>CO4</td>
<td>To understand data structures in python. oops concepts</td>
<td>PO5, PO7</td>
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<tr>
<td>CO5</td>
<td>To construct data and perform data analysis.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

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:

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,

@@@@
SEMESTER-II
COURSE 3: PYTHON FOR DATA SCIENCE

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₁</td>
<td>Implement a given problem as a python program.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO₂</td>
<td>To write loops and decision statements in Python.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO₃</td>
<td>To implement functions and modules in Python.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO₄</td>
<td>To implement different data structures in python.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO₅</td>
<td>To implement data analysis using pandas and graphs.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

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 number 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.
17. Generate scatter plot using Matplotlib.
18. Generate box plot using Matplotlib.

@@@@
SEMMESTER-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


Recommended References books:

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

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

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

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.
5. Computation of non-central, central moments, $\beta_1$ and $\beta_2$ 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

@@@@
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

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

<table>
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<tr>
<th>PROGRAM OUTCOME NO</th>
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<tbody>
<tr>
<td>PO5, PO7</td>
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<tr>
<td>PO5, PO7</td>
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<tr>
<td>PO5, PO7</td>
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<tr>
<td>PO5, PO7</td>
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<tr>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

Unit – I

Overview of Database Management Systems:

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:

Reference Book:
2. “Principles of Database Systems” by J.D. Ullman

Web Links:

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.
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.

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

WEEK 1:
Installing configuring running of Mongo db

WEEK 2:
Working with database 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 operations

WEEK 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 top 5 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.
**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:**

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

**UNIT – I**

**Operating System:**


**UNIT – II**

**Process and CPU Scheduling –**

UNIT – III

Memory Management and Virtual Memory –


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


REFERENCES BOOKS:


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.
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..

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

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

@@@
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

UNIT -II

UNIT -III

UNIT -IV

UNIT -V

Text Books:

<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
<th>Publisher</th>
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</table>

Reference Text Books:

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</table>
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,

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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.
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:

REFERENCE BOOKS

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

@@@@
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

@@@@
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:

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

UNIT I

UNIT II

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

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


**Reference 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)

**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,
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

@@@@
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

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

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:


REFERENCES


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.
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.
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.
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:

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the need of AI and Intelligent Agents.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand knowledge based agents and prepositional logic.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO3</td>
<td>Gain knowledge about learning agents and decision trees.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO4</td>
<td>Gain knowledge about practical applications of NLP.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand parts, tasks and architecture of Robotics.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

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:


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

REFERENCES
1. Artificial Neural Networks B. Yagna Narayana, PHI
3. Artificial Intelligence and Expert Systems – Patterson PHI.
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:
(Con-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,

@@@@
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:

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop various basic python programs.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse and develop solutions for various problems like water jug, Tic – Tack – Toe, etc.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop programs using DFS, BFS, A* and hill climbing algorithms.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop python programs for analysing given data set.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop python programs for implementing Bayes Classification.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

Lab List

1. A) Basic programs in python.
   B) Programs demonstrating list, Vector, Matrix and Array
3. Implementing DFS and BFS using Python.
5. Solve 8 – puzzle problem using hill climbing 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.

@@@@
SEMESTER-V
COURSE 12: PREDICTIVE ANALYTICS USING PYTHON

Course Objectives:

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

Course Outcomes:

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

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:


REFERENCE BOOKS:


2. L. Wasserman-All of statistics.


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,


@@@@
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

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

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.
10. Demonstrating random forests and analysis.
OBJECTIVE:
The course should enable the students to focus on developing machines that can think, which leads to gaining fundamental knowledge for understanding AI. These topics are closely related to 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:

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

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:

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. Computerized adaptive testing, literature surveys and evaluations,

@@@
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.

@@ @@ @@
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:

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>To understand the use of CFG and PCFG in NLP</td>
<td>PO5,P07</td>
</tr>
<tr>
<td>CO2</td>
<td>To learn control structures in python and apply them to real world problems.</td>
<td>PO5,P07</td>
</tr>
<tr>
<td>CO3</td>
<td>To understand the role of semantics of sentences and pragmatics</td>
<td>PO5,P07</td>
</tr>
<tr>
<td>CO4</td>
<td>To apply the NLP techniques to IR applications</td>
<td>PO5,P07</td>
</tr>
<tr>
<td>CO5</td>
<td>To construct data and perform data analysis.</td>
<td>PO5,P07</td>
</tr>
</tbody>
</table>

UNIT I INTRODUCTION


UNIT II WORD LEVEL ANALYSIS


UNIT III SYNTACTIC ANALYSIS


UNIT IV SEMANTICS AND PRAGMATICS

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES


TEXT BOOKS:

REFERENCES
1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.

Recommended Co – Curricular Activities:
(Concurricular 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,

@@@@
SEMESTER-V

COURSE 14: NATURAL LANGUAGE PROCESSING

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:

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

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

@@@@
SEMESTER-V
COURSE 15: SOFTWARE PROJECT MANAGEMENT

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

UNIT - II
PROJECT LIFE CYCLE AND EFFORT ESTIMATION:

UNIT - III
ACTIVITY PLANNING AND RISK MANAGEMENT:

UNIT - IV
PROJECT MANAGEMENT AND CONTROL:

UNIT - V
STAFFING IN SOFTWARE PROJECTS:
TEXT BOOK:


REFERENCES:

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:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>By the end of the course, students will be able to</th>
<th>Programme Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>implement function point analysis and models like flexi and SEL.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>CO2</td>
<td>implement basic, intermediate and detailed COCOMO.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

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

@@ @@ @
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:

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

UNIT I BASICS OF NEURAL NETWORKS
Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

UNIT II INTRODUCTION TO DEEP LEARNING

UNIT III CONVOLUTIONAL NEURAL NETWORKS
CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

UNIT IV MORE DEEP LEARNING ARCHITECTURES
UNIT V APPLICATIONS OF DEEP LEARNING


TEXT BOOK:


REFERENCES:


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,
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

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<td>3</td>
<td>To design and implement Deep Learning Applications.</td>
<td>PO6</td>
</tr>
<tr>
<td>4</td>
<td>Critically Analyse Different Deep Learning Models in Image Related Projects.</td>
<td>PO6</td>
</tr>
<tr>
<td>5</td>
<td>To design and implement Convolutional Neural Networks.</td>
<td>PO6</td>
</tr>
</tbody>
</table>

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

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 outcomes

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

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
- Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition  BY 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 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,

@@@@
SEMESTER-VII

COURSE 17: TEXT MINING

Practical Credits: 1 2 hrs/week

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>To extract tokens, Vocabulary and Punctuation</td>
<td>P07</td>
</tr>
<tr>
<td>CO2</td>
<td>To extract Part of speech Root of a word</td>
<td>P07</td>
</tr>
<tr>
<td>CO3</td>
<td>To extract Base of a word stop words using distributions</td>
<td>P07</td>
</tr>
<tr>
<td>CO4</td>
<td>To demonstrate Operations on Text</td>
<td>P07</td>
</tr>
<tr>
<td>O5</td>
<td>To implement parts of speech tagging Searching strings</td>
<td>P07</td>
</tr>
</tbody>
</table>

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

@@@@
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
Design issues of network layer, Virtual vs Datagram routing algorithms, Shortest path routing algorithm, Flooding, Distance vector routing algorithm, Congestion control algorithms.

UNIT IV: Transport Layer

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:
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:
2. https://www.w3schools.com/java/

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

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₁</td>
<td>Demonstrate ANN structure and activation Functions</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₂</td>
<td>Define foundations and learning mechanisms and state-space concepts</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₃</td>
<td>Identify structure and learning of perceptions.</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₄</td>
<td>Explain Feed forward, multi-layer feed forward networks and Back propagation algorithms</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₅</td>
<td>Analyze Radial Basis Function Networks, Theory Regularization and RBF networks fuzzy systems.</td>
<td>PO₅, PO₇</td>
</tr>
</tbody>
</table>

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:
UNIT IV:

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 boltzmann machine.


Reference Books:

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.
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:

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₁</td>
<td>Understand the characteristics and types of artificial neural network and remember working of biological Neuron and Artificial Neural Network</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₂</td>
<td>Apply learning algorithms on perceptron and apply back propagation learning on Neural Network.</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₃</td>
<td>Apply Back propagation algorithms application.</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₄</td>
<td>Design Convolutional Neural Network and classification using Convolutional Neural Network.</td>
<td>PO₅, PO₇</td>
</tr>
<tr>
<td>CO₅</td>
<td>Solve sequence learning problem and implement long short term memory and gated recurrent.</td>
<td>PO₅, PO₇</td>
</tr>
</tbody>
</table>

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.

@@@@
Course Objectives

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

Course Outcomes:

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

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. Evaluation, ranking of ideas, identifying best idea to solve the problem.

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

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 and challenging)
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B. General
1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:
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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,

SEMESTER-VIII
COURSE 22: DESIGN THINKING

<table>
<thead>
<tr>
<th>Practical</th>
<th>Credits: 1</th>
<th>2 hrs/week</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>COURSE OUTCOME NO</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to:</th>
<th>PROGRAM OUTCOME NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand process of Design thinking.</td>
<td>PO5</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop application using design thinking.</td>
<td>PO5,PO7</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply Design thinking to real world scenarios.</td>
<td>PO5,PO7</td>
</tr>
</tbody>
</table>

**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
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:

<table>
<thead>
<tr>
<th>CO. NO.</th>
<th>Upon successful completion of this course, students should have the knowledge and skills to</th>
<th>PO. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Outline the relationship between mechanical structures of industrial robots and their operational workspace characteristics.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>2</td>
<td>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.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>3</td>
<td>Develop an ability to obtain the Jacobian matrix and use it to identify singularities.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>4</td>
<td>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.</td>
<td>PO5, PO7</td>
</tr>
<tr>
<td>5</td>
<td>Recall the applications of robots in manufacturing, material handling, assembly and inspections and Illustrate the considerations of workspace for a given robot application.</td>
<td>PO5, PO7</td>
</tr>
</tbody>
</table>

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

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:

Reference Books:

Web Reference:

E-Book:

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,

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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

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<tbody>
<tr>
<td>1</td>
<td>Demonstrate Rhino robot arm configurations.</td>
<td>PO6</td>
</tr>
<tr>
<td>2</td>
<td>Implement numerical optimization and test errors</td>
<td>PO6</td>
</tr>
<tr>
<td>3</td>
<td>Implement K - Nearest algorithms</td>
<td>PO6</td>
</tr>
<tr>
<td>4</td>
<td>Implement Random forests analysis</td>
<td>PO6</td>
</tr>
</tbody>
</table>

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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