VISION OF THE DEPARTMENT:

To educate students with conceptual knowledge and technical skills in the field of Information Technology with moral and ethical values to achieve excellence in academic, industry and research centric environments.

MISSION OF THE DEPARTMENT:

1. To inculcate in students a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.

2. To provide a conducive environment for all academic, administrative and interdisciplinary research activities using state-of-the-art technologies.

3. To stimulate the growth of graduates and doctorates, who will enter the workforce as productive IT engineers, researchers and entrepreneurs with necessary soft skills and continue higher professional education with competence in the global market.

4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.

5. To cater to cross-cultural, multinational and demographic diversity of students.

6. To educate the students on the social, ethical and moral values needed to make significant contributions to society.
PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates can

- Utilize their proficiencies in the fundamental knowledge of basic sciences, mathematics, Artificial Intelligence, data science and statistics to build systems that require management and analysis of large volumes of data.
- Advance their technical skills to pursue pioneering research in the field of AI and Data Science and create disruptive and sustainable solutions for the welfare of ecosystems.
- Think logically, pursue lifelong learning and collaborate with an ethical attitude in a multidisciplinary team.
- Design and model AI based solutions to critical problem domains.
- Exhibit innovative thoughts and creative ideas for effective contribution towards economy building.

PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Information Technology Graduates will exhibit ability to:

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<th>Graduate Attribute</th>
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<tr>
<td>1</td>
<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
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<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
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<td>Design/development of solutions</td>
<td>Design a system or process to improve its intelligence, performance, satisfying its constraints.</td>
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<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret the data.</td>
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<td>Modern tool usage</td>
<td>Apply various tools and techniques to improve the efficiency of the system.</td>
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<td>6</td>
<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
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<tr>
<td>No.</td>
<td>Environment and sustainability</td>
<td>Design the system with environment consciousness and sustainable development.</td>
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<td>Ethics</td>
<td>Interact in industry, business and society in a professional and ethical manner.</td>
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<td>Individual and team work</td>
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<td>Project management and finance</td>
<td>Implement cost effective and improved system.</td>
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<td>Life-long learning</td>
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**PROGRAM SPECIFIC OUTCOMES (PSOs):**

Graduates should be able to:

1. Apply the theoretical knowledge of AI and Data Science for effective decision making in business and governance domains.
2. Develop the skills in data analytics and data visualization, pertaining to knowledge acquisition, knowledge representation and knowledge engineering and hence capable of coordinating complex projects.
3. Accomplish research to cater the critical needs of the society through cutting edge technologies of AI.
# ANNA UNIVERSITY, CHENNAI
## UNIVERSITY DEPARTMENTS
### B. TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
#### REGULATIONS – 2019
##### CHOICE BASED CREDIT SYSTEM
#### CURRICULA AND SYLLABI FOR I - VIII SEMESTER

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# Skill Based Course

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# Value Added Courses
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*Skill Based Course

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# HSMC Courses

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$^\circ$ Skill Based Courses

## AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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Total Credits: 24
OBJECTIVES

- To build lexical competency and accuracy that will help learners to use language effectively.
- To learn various reading strategies that will enable learners to comprehend the different modes of reading materials of varied levels of complexity.
- To comprehend the linguistic aspects of various rhetorical structures and functions of Technical English and use them effectively in writing.

UNIT I INTRODUCING ONESELF
Theory:
Reading: Descriptive passages (From Newspapers / Magazines) – Writing: Writing a coherent paragraph (Native Place, School Life) – Grammar: Simple present tense, Present continuous tense – Vocabulary development: One word substitution.

UNIT II DIALOGUE WRITING
Theory:
Reading: Reading a print interview (Comprehension and inference questions) - Writing: Writing a checklist - Dialogue writing – Grammar: Simple past tense – Question formation (Wh-Questions, ‘Yes’ or ‘No’ Questions, Tag Questions) – Vocabulary Development: Lexical items relevant to the theme of the given unit.

UNIT III FORMAL LETTER WRITING
Theory:

UNIT IV WRITING LETTERS OF COMPLAINT
Theory:

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION
Theory:

TOTAL : 45 PERIODS

LEARNING OUTCOMES:
On completion of the course, the students will be able to:

- Use appropriate language structures and lexical items in authentic contexts.
- Read both general and technical texts and comprehend their denotative and connotative meanings.
• Write different kinds of formal documents with grammatical and lexical appropriacy.

**Assessment Pattern**

• Two written internal assessments to test learner’s progress in grammar, vocabulary, reading and writing skills.
• End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills for two hours.

**MA5158**

**ENGINEERING MATHEMATICS – I**

(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

**OBJECTIVES:**

• To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
• To familiarize the students with differential calculus.
• To familiarize the student with functions of several variables. This is needed in many branches of engineering.
• To make the students understand various techniques of integration.
• To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

**UNIT I MATRICES**

12


**UNIT II DIFFERENTIAL CALCULUS**

12


**UNIT III FUNCTIONS OF SEVERAL VARIABLES**

12


**UNIT IV INTEGRAL CALCULUS**

12

Definite and Indefinite Integrals – Substitution Rule – Techniques of Integration – Integration by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fraction, Integration of Irrational Functions – Improper Integrals.

**UNIT V MULTIPLE INTEGRALS**

12

Double Integrals – Change of Order of Integration – Double Integrals in Polar Coordinates – Area

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

REFERENCES:

PH5151 ENGINEERING PHYSICS  L  T  P  C  3  0  0  3
(Common to all branches of B.E / B.Tech programmes)

OBJECTIVE
- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.
UNIT I MECHANICS

- Moment of Inertia (M.I) - Radius of Gyration
- Theorems of M.I - M.I of Circular Disc, Solid Cylinder, Hollow Cylinder, Solid Sphere and Hollow Sphere

UNIT II ELECTROMAGNETIC WAVES

- Gauss’s Law - Faraday’s Law - Ampere’s Law - The Maxwell’s Equations - Wave Equation

UNIT III OSCILLATIONS, OPTICS AND LASERS


UNIT IV BASIC QUANTUM MECHANICS

- Photons and Light Waves - Electrons And Matter Waves - The Schrodinger Equation (Time Dependent and Time Independent Forms) - Meaning of Wave Function - Normalization - Particle in a Infinite Potential Well - Normalization, Probabilities and the Correspondence Principle.

UNIT V APPLIED QUANTUM MECHANICS

- The Harmonic Oscillator - Barrier Penetration and Quantum Tunneling - Tunneling Microscope - Resonant Diode - Finite Potential Wells - Particle in a Three Dimensional Box - Bloch’s Theorem for Particles in a Periodic Potential, Kronig-Penney Model and Origin of Energy Bands.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understanding the importance of mechanics.
2. Express the knowledge of electromagnetic waves.
3. Know the basics of oscillations, optics and lasers.
4. Understanding the importance of quantum physics.
5. Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

REFERENCES:

CY5151

ENGINEERING CHEMISTRY

(COMMON TO ALL BRANCHES)

L  T  P  C

3   0   0   3

OBJECTIVES:
- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I  POLYMER CHEMISTRY


UNIT II  NANO CHEMISTRY


UNIT III  PHOTO CHEMISTRY AND SPECTROSCOPY


UNIT IV  ENERGY CONVERSIONS AND STORAGE

Ion-Battery). Fuel Cells – $\text{H}_2$-$\text{O}_2$ and Microbial Fuel Cell. Explosives – Classification, Examples: TNT, RDX, Dynamite; Rocket Fuels and Propellants – Definition and Uses.

**UNIT V  WATER TECHNOLOGY**


**OUTCOMES:**
On completion of the course, the students will be able to:
1. Recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
2. Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. Identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
4. Recognize different forms of energy resources and apply them for suitable applications in energy sectors.
5. Demonstrate the knowledge of water and their quality in using at different industries.

**TEXT BOOKS:**

**REFERENCES:**

**GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING**

**OBJECTIVES:**
- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.
UNIT I
INTRODUCTION TO COMPUTING AND PROBLEM SOLVING


Suggested Activities:
• Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
• Developing algorithms for basic mathematical expressions using arithmetic operations.
• Installing Python.
• Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods:
• Assignments on pseudocodes and flowcharts.
• Tutorials on Python programs.

UNIT II
CONDITIONALS AND FUNCTIONS


Suggested Activities:
• Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
• Implementation of a simple calculator.
• Developing simple applications like calendar, phone directory, to-do lists etc.
• Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
• External learning - Recursion vs. Iteration.

Suggested Evaluation Methods:
• Tutorials on the above activities.
• Group discussion on external learning.

UNIT III
SIMPLE DATA STRUCTURES IN PYTHON


Suggested Activities:
• Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
• External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods:
• Tutorials on the above activities.
• Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES

Suggested Activities:
• Implementing Python program by importing Time module, Math package etc.
• Creation of any package (student's choice) and importing into the application.

Suggested Evaluation Methods:
• Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING
Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities:
• Developing modules using Python to handle files and apply various operations on files.
• Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
• Implementing Python program to open a non-existent file using exceptions.

Suggested Evaluation Methods:
• Tutorials on the above activities.
• Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

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GE5154 HERITAGE OF TAMILS L T P C 1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports
of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழர் மரபு - மாற்றம் பரப்படம் - மத போன்ற பலித்தரம் (கல்வியியல் பலரஞ்சத்தரம் மதம் கல்வி பச்சைத்தரம் கல்வியீடு).
2. கைவிழாவில் குழிய - (முதலாம் முதல் குழிய).
3. சிவன் - வரலை சிற்றிலக்கியம் சுதந்திரம் தோன்ற குற்றம் (கல்வியியல் தக்க பாடுப்பு).
4. பாருகும்பு - குருதுகோலா குற்றம் (தமிழீன் தக்க பாடுப்பு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE5154 சிறுமி மரப் L T P C 1 0 0 1

அங்கிற பகுதியின் தலைக்குறிகள்:
அலகு II பார்வை - பட்டக சுருக்கக் குறியீடு சுருக்கக் குறியீடு - வினங்க சுருக்கக் குறியீடு: பத்மநாத சிற்றகு கறல் முதல் நவீன சிற்றகு கறல் வறர் - சிற்றகு கறல்: 3 நடுகல் முதல் நவீன சிற்றகங்கள் வளர் - ஐம்தபொன் சிளலகள் - மற்றும் அவர்கள் தயொரிக்கும் பகவிளனத்தபொருட்கள், தபொம்ளமகள் - கதர் தசய்யும் களல் - சுடுமண்சிற்றகள் - நொட்டுப்புறத் ததய்வங்கள் - குமரிமுளனயில் திருவள்ளுவர் சிளல – இளசக் கருவிகள் - மிருதங்கம், பளற, வீளண், யொழ், நொதஸ் வரம் - தமிழர்களின் சமூகதபொருளொதொரவைல் ககொவில்களின் பங்கு.

அலகு III கம்பிப்பட்டகக் குறியீடு மற்றும் விளக்ககுறியீடு: 3 விளக்ககுறியீடு, கரக்கொட்டம், கிளாம்ப்பந்தர், சிற்றகம், சிற்றகங்கள், கிளாம்ப்பந்தர், வார்தை, புரிதல், துணைக்குறியீடுகள், விளக்ககுறியீடு.

அலகு IV துணைக்குறியீடு விளக்ககுறியீடுகள்: 3 துணைக்குறியீடு விளக்ககுறியீடுகள், சிற்றககுறியீடு - துணைக்குறியீடு மற்றும் துணைக்குறியீடுகள் அதும் பாடல் வார்தைகம் - துணைக்குறியீடு விளக்ககுறியீடுகள் - துணைக்குறியீடுகளை துணைக்குறியீடு மற்றும் துணைக்குறியீடு - குழுக்குறியீடு விளக்ககுறியீடுகள் நடந்தவர்.

அலகு V துணை விளக்க பாதுகாப்பு மத்திய விளக்க பாதுகாப்புகள் துணைக்குறியீடுகள் பொறியியல்: 3 துணை விளக்க பாதுகாப்புகள், துணைக்குறியீடுகள் - துணைக்குறியீடுப் பாதுகாப்புகள் குறக்கு தமிழக விளக்க பாதுகாப்புகள் - துணைக்குறியீடுப் பாதுகாப்புகள், சிற்றககுறியீடுகளை பாதுகாப்புகள் - துணைக்குறியீடுப் பாதுகாப்புகள் அதும் விளக்கம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தொழில் மறை - மாதுரை பார்வையும் - ச.த.் பிரசுட் (தொழில்: தொழில் பார்வையும் பத்மநாத மறை).
2. விளக்ககுறியீடு விளக்ககுறியீடு (சிற்றககுறியீடு).
3. ஆண்டு - நவீன சிற்றககுறியீடு சிற்றககுறியீடு (தொழில்: பத்மநாத மறை).
4. பார்வையும் - ச.த.் பிரசுட். (தொழில்: பார்வையும்)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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BS5161 BASIC SCIENCES LABORATORY
(Common to all branches of B.E. / B.Tech Programmes)

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE
- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS:
4. Lee’s disc Determination of thermal conductivity of a bad conductor.
5. Potentiometer – Determination of thermo e.m.f of a thermocouple.
9. Compact disc – Determination of width of the groove using laser..
10. Acoustic grating – Determination of velocity of ultrasonic waves in liquids.
11. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
15. Michelson Interferometer.
17. Melde’s string experiment.

TOTAL: 30 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Determine various moduli of elasticity and also various thermal and optical properties of materials.
2. Determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.
BASIC SCIENCE LABORATORY

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pHmetry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
2. Determine the amount of metal ions through volumetric and spectroscopic techniques.
3. Determine the molecular weight of polymers by viscometric method.
4. Quantitatively analyse the impurities in solution by electroanalytical techniques.
5. Design and analyse the kinetics of reactions and corrosion of metals.

TEXT BOOKS:

OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

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OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION  6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II  NARRATION AND SUMMATION  6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT  6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS  6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V  EXPRESSION  6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able

- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN

- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

HS5251 PROFESSIONAL COMMUNICATION L T P C 2 0 0 2

OBJECTIVES
- To comprehend various reading materials relevant to technical context and understand the main and supporting ideas of the reading materials.
- To write effective job applications along with detailed CV for internship or placements.
- To explore definitions, essay and report writing techniques and practice them in order to develop associated skills.

UNIT I TECHNICAL COMMUNICATION 6
Theory:
Reading: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting) – Writing: Writing a Short Biography of an Achiever Based on Given Hints – Grammar: Asking and Answering Questions, Punctuation in Writing, Prepositional Phrases

UNIT II SUMMARY WRITING 6
Theory:
Reading: Reading Technical Essays/ Articles and Answering Comprehension Questions – Writing: Summary Writing – Grammar: Participle Forms, Relative Clauses

UNIT III PROCESS DESCRIPTION 6
Theory:
Reading: Reading Instruction Manuals – Writing: Writing Process Descriptions – Writing Instructions – Grammar: Use of Imperatives, Active and Passive Voice, Sequence Words

UNIT IV REPORT WRITING 6
Theory:
Reading: Reading and Interpreting Charts/Tables and Diagrams – Writing: Interpreting Charts/Tables and Diagrams, Writing a Report – Grammar: Direct into Indirect Speech, Use of Phrases

UNIT V WRITING JOB APPLICATIONS 6
Theory:
Reading: Reading a Job Interview, SOP, Company Profile and Completing Comprehension Exercises – Writing: Job Applications and Resumes And Sops-Grammar: Present Perfect and Continuous Tenses.

TOTAL : 30 PERIODS

LEARNING OUTCOMES
On completion of the course, the students will be able to:

- Read and comprehend technical texts effortlessly.
- Write technical reports and job application for internship or placement.
- Learn to use language effectively in a professional context.
Assessment Pattern

- Two written internal assessments to test learner’s progress in grammar, reading and writing skills.
- End Semester exam to be tested in two parts: Theory exam for three hours and listening and speaking skills along with vocabulary for two hours.

MA5252 ENGINEERING MATHEMATICS – II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4

OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS

UNIT II ANALYTIC FUNCTION

UNIT III COMPLEX INTEGRATION

UNIT IV DIFFERENTIAL EQUATIONS
Method of Variation of Parameters – Method of Undetermined Coefficients – Homogenous Equations of Euler’s and Legendre’s Type – System of Simultaneous Linear Differential Equations with Constant Coefficients.

UNIT V LAPLACE TRANSFORMS
Transform of Periodic Functions – Application to Solution of Linear Ordinary Differential Equations With Constant Coefficients.

TOTAL : 60 PERIODS

OUTCOMES:
On completion of the course, students will be able to:

1. Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
2. Construct analytic functions and use their conformal mapping property in application problems.
3. Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
4. Apply various methods of solving differential equation which arise in many application problems.
5. Apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS:

REFERENCES:

AZ5201 OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES L T P C
3 0 0 3

OBJECTIVES:
- To understand the Object Oriented Programming(OOP) language concepts.
- To learn and implement different data structures using OOP concepts.
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs in real world problems
- To familiarize the techniques of Sorting, Searching and Hashing.

UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS 8
C++ - Data abstraction – encapsulation - Class – objects – Constructors - Static members - constant members - member functions – pointers - string handling - copy constructor - polymorphism – Function overloading - operators overloading Dynamic Memory Allocation.
Suggested Activities:
- Flipped Classroom - Features of OOP, Pointers.
- External learning - Dynamic memory allocation operators and its usage.
- Exploration of examples on static functions and usage of ‘this’ pointer.
- Exploration of the usage of reference variables, pointer to reference and reference to a pointer.
- Application development using Friend functions and function overloading.

Suggested Evaluation Methods:
- Assignments on the usage of dynamic memory allocation operators, Friend functions and reference variables.
- Quizzes on pointers and usage of pointers.
- Demonstration of the application development.

UNIT II  OBJECT ORIENTED PROGRAMMING - ADVANCED FEATURES  8

Suggested Activities:
- Flipped Classroom on basics of exception handling.
- External learning - STL Containers and Iterators.
- Practical - Solve a given problem (such as Vector Manipulation, List Updation) by choosing appropriate functions from STL.
- Exploration on the usage of Virtual Functions and Abstract Classes.
- Application development using exception handling.

Suggested Evaluation Methods:
- Assignments on problem solving using STL.
- Quizzes on exception handling, abstract classes.
- Demonstration for application development.

UNIT III  LINEAR DATA STRUCTURES – LIST, STACK, QUEUE  8

Suggested Activities:
- Flipped classroom on priority queue
- Converting an algorithm from recursive to non-recursive using stack.
- Demonstrating stack for Towers of Hanoi application
- Developing any application using all the linear data structures.

Suggested Evaluation Methods:
- Tutorials on applications of linear data structures.
- Checking output of programs implemented

UNIT IV  NON LINEAR DATA STRUCTURES – TREES AND GRAPH  12
Suggested Activities:
- Flipped classroom on binary search trees and graph traversal application
- External learning - Fibonacci heap
- Exploration of application of trees where trees can be applied for real time problems.
- Exploration of other single source shortest path problems.
- Practical - Design and Implementation of a suitable tree/heap structure for solving a given real time problem such as implementation of syntax trees in compilers

Suggested Evaluation Methods:
- Assignments on Fibonacci Heaps, Real time problem solving using Trees and graph.
- Quizzes on BST, Binary Heap, Graph.
- Demonstration of practical learning component.

UNIT V SORTING, SEARCHING AND HASHING TECHNIQUES


Suggested Activities:
- Flipped classroom on selection sort.
- External learning - External sorting implementation.
- Implementation of all sorting techniques.
- Demonstration of searching techniques under best and worst case inputs.

Suggested Evaluation Methods:
- Tutorials on External sorting.
- Checking output of programs implemented.

OUTCOMES:
Upon the completion of the course the student should be able to
- Implement advanced data structures through ADTs using OOP.
- Select and use appropriate linear/non–linear data structure for solving a given problem.
- Apply suitable hierarchical data structures to solve practical problems.
- Apply the graph data structures for a real world problem.
- Appropriately use sort, search, hash techniques for a given application.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits, and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I  BASIC CIRCUITS AND DOMESTIC WIRING


UNIT II  THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS


UNIT III  ELECTRICAL MACHINES


UNIT IV  BASICS OF ELECTRONICS


UNIT V  CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES

Working Principle and Characteristics – BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: To be able to understand the concepts related with electrical circuits and wiring.
CO2: To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3: Capable of understanding the operating principle of AC and DC machines.
CO4: To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5: To be able to understand the characteristics and working of current controlled and voltage controlled devices.
TEXT BOOKS:

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GE5151 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
- To draw free hand sketches of basic geometrical shapes and multiple views of objects.
- To draw orthographic projections of lines and planes.
- To draw orthographic projections of solids.
- To draw the development of surfaces of objects.
- To draw isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)

UNIT I PLANE CURVES AND FREE HANDSKETCHING
UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  15

UNIT III  PROJECTION OF SOLIDS  15
Projection of Simple Solids like Prisms, Pyramids, Cylinder, Cone and Truncated Solids When the Axis is Inclined to Both the Principal Planes by Rotating Object Method and Auxiliary Plane Method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  15
Sectioning of Solids in Simple Vertical Position When the Cutting Plane is Inclined to the One of the Principal Planes and Perpendicular to the other – Obtaining True Shape of Section. Development of Lateral Surfaces of Simple and Sectioned Solids – Prisms, Pyramids Cylinders and Cones. Development of Lateral Surfaces Of Solids With Cut-Outs and Holes.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  12

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)  3
Introduction to Drafting Packages and Demonstration of Their Use.

TOTAL (L: 15 + P: 60):75 PERIODS

COURSE OUTCOMES:
On completion of this course, the students will be able to:
1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

REFERENCES:
Publication of Bureau of Indian Standards:

Special Points Applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
   The examination will be conducted in appropriate sessions on the same day.

GE5252 TAMILS AND TECHNOLOGY L T P C
1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழ் வரலை – மக்களும் பணகிடும் – கக.கக.பிள்ளள் (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும்)
2. கல்வியியல் பணிகள் (விளையாட்டு பிரசுரம்).
3. சுந்தரம் - கணினித் தமிழ் முளனவர் இலைசுதூரம் (தொல்லியல் தொகுப்பு).
4. பாரதுரு - குற்றுப்பாடு தரைகம். (தொல்லியல் தொகுப்பு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE5252 கல்வியியல் முனைவு

அலகு I இணை முனைவுப் பரப்புகள் இணைவுப் பரப்புகள்: 3

அலகு II பொருள் முனைவுப் பரப்புகள் இணைவுப் பரப்புகள்: 3

�லகு III முனைவுப் பரப்புகள் இணைவுப் பரப்புகள்: 3
OBJECTIVES:
- To understand the concepts of Object Oriented Programming.
- To use standard template library in the implementation of standard data structures.
- To learn the data structures using Object Oriented Programming (OOP) language.
- To explore linear and non-linear structures using OOP concepts.
• To understand various sorting, searching algorithms using OOP concepts.

**LIST OF EXPERIMENTS: Implement the following exercises using C++:**

1. Practice of C++ Programming on real world/technical applications using statements, expressions, decision making constructs, iterative and branching constructs, structures, arrays, functions, pointers.
2. Implementation of Stack and queue using Arrays and Linked List.
3. Implementation of Binary Search Tree, AVL.
4. Implementation of Insertion sort, Quick Sort, Merge Sort.
5. Implementation of an Application (such as Library Management System) using Classes, Objects, Constructors, Destructors and String Handling.
7. Implementation of an Application such as Student Information System using Inheritance, Virtual Functions and Abstract Classes.
8. Implementation of a Heap tree using Templates.
10. Implementation of List, Stack and Queue Data Structures using STL Concepts.
11. Mini Project

**TOTAL: 60 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:

• Implement the basic and advanced concepts of object-oriented programming.
• Solve the given problem using object oriented concepts.
• Implement linear and non-linear data structures through ADTs using OOP.
• Analyze and apply the sorting, searching and hashing techniques for a real world problem.
• Design and develop real time applications by applying suitable data structures and associated operations.

**EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**

**OBJECTIVES**

• To impart hands on experience in verification of circuit laws and measurement of circuit parameters
• To train the students in performing various tests on electrical motors.
• To give practical exposure to the usage of CRO, power sources & function generators

**LIST OF EXPERIMENTS**

1. Verification of Kirchhoff’s Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.
2. Perform speed characteristic of different electrical machines.
3. Use logic gates and Flip flops.

GE5262 COMMUNICATION LABORATORY

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II
Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures-talking about travel problems- making arrangements-discussing arrangements-discussing plans and decisions-discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNIT III
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons-discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV
Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example-discussing rental arrangements)-understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V
Speaking: describing things relatively-describing clothing-discussing safety issues( making recommendations) talking about electrical devices-describing controlling actions- Writing: job application( Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.
Assessment Pattern

- One online / app based assessment to test speaking and writing skills
  Proficiency certification is given on successful completion of speaking and writing.

MA5302  DISCRETE MATHEMATICS  L T P C
3 1 0 4

UNIT I  LOGIC AND PROOFS  12

UNIT II COMBINATORICS  12

UNIT III  GRAPHS  12
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT IV  ALGEBRAIC STRUCTURES  12

UNIT V  LATTICES AND BOOLEAN ALGEBRA  12

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the validity of the logical arguments, mathematical proofs and correctness of the algorithm.
2. Apply combinatorial counting techniques in solving combinatorial related problems.
3. Use graph models and their connectivity, traversability in solving real world problems.
4. Understand the significance of algebraic structural ideas used in coding theory and cryptography.
5. Apply Boolean laws and Boolean functions in combinatorial circuit designs.

TEXTBOOKS:
REFERENCES:

AZ5301 DIGITAL LOGIC AND COMPUTER ORGANIZATION L T P C
2 0 2 3

UNIT I DIGITAL LOGIC FUNDAMENTALS 6

UNIT II COMBINATIONAL AND SEQUENTIAL LOGIC 6

UNIT III COMPUTER FUNDAMENTALS 6

UNIT IV PROCESSOR 6
Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Structural Hazards - Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O 6

PRACTICAL EXERCISES:
1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture (MARS based basic exercises)

TOTAL: 30 PERIODS 30 PERIODS
COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1 : To learn Boolean algebra and simplification of Boolean functions.
CO2 : Design various combinational digital circuits using logic gates
CO3 : Design sequential circuits and analyze the design procedures
CO4 : State the fundamentals of computer systems and analyze the execution of an instruction
CO5 : Analyze different types of control design and identify hazards
CO6 : Identify the characteristics of various memory systems and I/O communication

TOTAL: 60 PERIODS

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IT5402 DESIGN AND ANALYSIS OF ALGORITHMS L T P C 3 0 0 3

UNIT I FUNDAMENTALS
Suggested Activities:
- Discussion on role of algorithms in computer science.
- External learning - Design of simple problems, sample problems in Hackerrank, like, diagonal difference in matrices, staircase construction.
- Computation of step count and operation count for merge sort and Quicksort.
- Design of induction proofs for algorithm verification for recursive algorithms.
- Practical - Implementation of time complexity in Python.

Suggested Evaluation Methods:
- Tutorials on operation count and step count for iterative algorithms such as linear search and array sum.
- Assignments on recursive algorithm analysis and Master Theorem.
- Quizzes on algorithm writing.

UNIT II DESIGN TECHNIQUES


Suggested Activities:
- External learning - Divide and conquer based algorithms, Hackerrank divide and conquer algorithms.
- External learning - Dynamic programming based algorithms like coin change.
- Computation of step count and operation count.
- Design of Induction Proofs for algorithm verification.
- Practical - Implementation of Merge sort and Longest Common Sequence like Spell Checker, Hackerrank problems like coin change.

Suggested Evaluation Methods:
- Tutorials on matrix chain multiplication and longest common sequence.
- Assignments on string edit and string basics.
- Quizzes on algorithm design.

UNIT III GREEDY APPROACH AND MATRIX OPERATIONS


Suggested Activities:
- Flipped classroom on algorithm design.
- External learning - Greedy approach based algorithms like set cover and vertex. cover – Hackerrank problems like Password cracker.
- Computation of step count and operation count of Huffman code.
- Design of greedy based proofs for set cover problems.
- Practical - Implementation of matrix inverse using Gaussian Elimination problem.

Suggested Evaluation Methods:
- Tutorial on Huffman code and task scheduling.
- Assignments on LUP Decomposition and Matrix Inverse using matrix decomposition.
- Quizzes on greedy approach.

**UNIT IV  LINEAR PROGRAMMING**


**Suggested Activities:**
- Flipped classroom on Linear Algebra, Linear Programming basics
- External learning - Problems like Diet Problem in Hackerrank.
- Formulation of Duality for simple Linear Programming problems like Diet Problem.
- Practical - Implementation of Simplex algorithm.

**Suggested Evaluation Methods:**
- Tutorials on linear programming.
- Assignments in duality and linear programming problem formulations.
- Quizzes on linear programming.

**UNIT V  COMPUTATIONAL COMPLEXITY**


**Suggested Activities:**
- Flipped classroom on computational complexity.
- External learning - NP complexity, Turing machines.
- Computation and derivation of exponential complexity for set cover and vertex cover problems.
- Design of approximation bounds for randomized quicksort.
- Practical - Implementation of approximation algorithm for set cover problem.

**Suggested Evaluation Methods:**
- Tutorials on NP-complete proofs such as SAT problem.
- Assignments on set cover and vertex cover approximation problems.
- Quizzes on computational complexity.

**OUTCOMES:**
On completion of the course, the student will be able to:
- CO1: Articulate the process of problem solving and writing algorithms.
- CO2: Understand different algorithmic design strategies.
- CO3: Design and implement any problem using design techniques.
- CO4: Critically analyse the complexity of the given algorithm.
- CO5: Solve a problem in polynomial time or prove that to be an NP-Complete problem.
- CO6: Obtain knowledge of advanced topics such as approximation algorithms, linear programming and randomized algorithms.

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IT5351 DATABASE MANAGEMENT SYSTEMS L T P C 3 0 0 3

UNIT I RELATIONAL DATABASES

Suggested Activities:
- Creating tables with key constraints, adding and removing constraints with referential integrity using DDL commands.
- Flipped classroom on relational algebra operations (selection, projection, joins etc.).
- Write SQL queries for demonstrating CRUD operations, aggregate functions and various join operations using DML commands.
- Create stored procedures for executing complex SQL transactions.
- Create triggers for alerting user/system while manipulating data.

Suggested Evaluation Methods:
- Tutorials on DDL, DML and DCL queries.
- Quizzes on relational algebra operations.
- Demonstration of created stored procedures and triggers.

UNIT II DATABASE DESIGN
Suggested Activities:
- Simple database application design using ER diagram.
- Practical - ER modeling using open source tools and realizing database.
- Study of various anomalies and normalizing table (1NF, 2NF, 3NF, BCNF).
- Flipped classroom on topics of database design and normalization.

Suggested Evaluation Methods:
- Tutorials on application specific ER Diagram.
- Tutorials on normalization and database design.

UNIT III TRANSACTION MANAGEMENT 9

Suggested Activities:
- Checking serializability among transactions.
- Flipped classroom on concurrency control protocols.
- Study of crash recovery algorithm (ARIES).

Suggested Evaluation Methods:
- Tutorials on serializability and crash recovery algorithm
- Quizzes on concurrency control protocols.

UNIT IV IMPLEMENTATION TECHNIQUES 9

Suggested Student Activities:
- Study of different RAID levels and its uses in different applications.
- Practical - Creation of B+ tree with insertion and deletion operations.
- Assignments on cost estimation of different types of queries.

Suggested Evaluation Methods:
- Report on applications of RAID levels.
- Tutorials on B+ Tree manipulation.
- Quizzes on hashing mechanisms.
- Exercise on cost estimation for various SQL queries.
- Evaluation of the practical assignments.

UNIT V ADVANCED TOPICS 9

Suggested Student Activities:
- Design of distributed database using fragmentation.
- Creation of XML document based on XML schema.
• Creation of document and column oriented databases and simple manipulation.

Suggested Evaluation Methods:
• Tutorials on fragmenting database tables and writing simple SQL queries.
• Assignments on creation of XML schema and validating XML documents.
• Demonstration of created document and column-oriented databases.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Model an application’s data requirements using conceptual modeling and design database schemas based on the conceptual model.
CO2: Formulate solutions to a broad range of query problems using relational algebra/SQL.
CO3: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4: Run transactions and estimate the procedures for controlling the consequences of concurrent data access.
CO5: Explain basic database storage structures, access techniques and query processing.
CO6: Describe distributed, semi-structured and unstructured database systems.

TEXT BOOKS:

REFERENCES:
UNIT I  INTRODUCTION
Introduction to Data Science - Overview of Data - Sources of Data - Types of Data - Small Data and Big Data - Data collection methods - Surveys - Interviews - Log and Diary data - User studies in Lab and Field - Web Scapping - Public datasets - Data cleaning - Tools for Data Science.

Suggested Activities:
- Survey of Python tools for data science
- External Learning: Web scraping

Suggested Evaluation Methods:
- Quiz on python tools
- Seminar on web scraping

UNIT II  DESCRIPTIVE DATA ANALYSIS
Dataset Construction - Sampling of data - Stem and Leaf Plots - Frequency table - Time Series data - Central Tendency Measures of the location of data - Dispersion measures - Correlation analysis - Data reduction techniques - Principal Component analysis - Independent component analysis – Hypothesis testing – Statistical Tests

Suggested Activities:
- Flipped classroom on qualitative and quantitative datasets
- Tutorial on Sampling and Frequency
- Problem solving using central tendency measures
- Tutorial on Data reduction techniques

Suggested Evaluation Methods:
- Quiz on the type of datasets
- Assignment on determining central tendency measures
- Programming exercise on correlation analysis on a large set of data

UNIT III  MODEL CONSTRUCTION
Overview of Machine learning concepts – Model construction using regression and Classification models - Linear regression and multiple regression models - KNN classification models - Comparison models - Training Data construction - Regression line – least squares regression line – standard error of estimate – interpretation of $r^2$ – multiple regression equations – regression toward the mean

Suggested Activities:
- Implement linear regression models using python
- Implementation of KNN models

Suggested Evaluation Methods:
- Seminar on Regression models
UNIT IV  DATA HANDLING AND MODEL EVALUATION

Data aggregation – Data Transformation: merging datasets, reshaping data – Data enrichment: missing values - Normalization - Cross-validation techniques - Accuracy metrics for evaluation of models – Contingency table, ROC curve, Precision-recall curves - A/B testing

Suggested Activities:
- Construct a contingency table for classifier evaluation

Suggested Evaluation Methods:
- Seminar on aggregation and grouping
- Quiz on evaluation measures

UNIT V  DATA ANALYTICS

Introduction- Information based learning-Handling alternative feature selection and Impurity metrics-continuous descriptive features and Targets-Similarity based learning- Feature space- Predicting continuous targets-Error based learning- Measuring Error-Error surfaces.

Suggested activities
- Learning based exercises
- Flipped classroom in learning models

Suggested Evaluation Methods:
- Seminar on data analytics applications
- Seminar on Probability based learning

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course Students will be able to:
- Apply the skills of data inspecting and cleansing.
- Determine the relationship between data dependencies using statistics
- Can handle data using primary tools used for data science in Python
- Represent the useful information using mathematical skills
- Can apply the knowledge for data describing and visualization using tools.

TEXT BOOKS:

REFERENCES:
3. https://www.coursesidekick.com/statistics/study-guides/introstats1
LIST OF EXPERIMENTS:
1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   a. Bivariate analysis: Linear and logistic regression modeling
   b. Multiple Regression analysis
   c. Also compare the results of the above analysis for the two data sets.
7. Apply and explore various plotting functions on UCI data sets.
   a. Normal curves
   b. Density and contour plots
   c. Correlation and scatter plots
   d. Histograms
   e. Three-dimensional plotting
8. Visualizing Geographic Data with Basemap

List of Equipments:
Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh
Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

COURSE OUTCOMES:
At the end of this course, the students will be able to:
1. Make use of the python libraries for data science
2. Make use of the basic Statistical and Probability measures for data science.
3. Perform descriptive analytics on the benchmark data sets.
4. Perform correlation and regression analytics on standard data sets
5. Present and interpret data using visualization packages in Python.
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IT5312 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C 0 0 4 2

LABORATORY EXERCISES:
1. Create a database table, add constraints (primary key, unique, check, not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in database table.
9. Create View and index for database tables with large number of records.
10. Create a XML database and validate it using XML schema.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features.

COURSE OUTCOMES:

On completion of the course, the student will be able to:
CO1: Create databases with different types of key constraints.
CO2: Write simple and complex SQL queries using DML and DCL commands.
CO3: Realize database design using 3NF and BCNF.
CO4: Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO5: Create XML database and validate with meta-data (XML schema).
CO6: Create and manipulate data using NOSQL database.
GE5361                           PROFESSIONAL DEVELOPMENT                                     L T P C
                                           10 Hours

OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL:

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

**MS POWERPOINT:**
10 Hours
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

**OUTCOMES:**
On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their
day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per
requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common
tables, charts, graphs, interlinking other elements, and using media objects.

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**GE5251 ENVIRONMENTAL SCIENCES**

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**
Definition, Scope And Importance of Environment – Need for Public Awareness - Concept of an
Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers
Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest
Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds,
Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity Definition: Genetic,
Species and Ecosystem Diversity – Bio Geographical Classification of India – Value of Biodiversity:
Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at
Global, National and Local Levels – India as a Mega-Diversity Nation – Hot-Spots of Biodiversity –
Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and
Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of
Biodiversity. Field Study of Common Plants, Insects, Birds Field Study of Simple Ecosystems –
Pond, River, Hill Slopes, Etc.
UNIT II  ENVIRONMENTAL POLLUTION

Definition – Causes, Effects and Control Measures of: (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management: Causes, Effects and Control Measures of Municipal Solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – Disaster Management: Floods, Earthquake, Cyclone and Landslides. Field Study of Local Polluted Site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES


UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V  HUMAN POPULATION AND THE ENVIRONMENT


OUTCOMES:

On completion of the course, the students will be able to:
1. Recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
2. Identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
3. Identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4. Recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.

TOTAL: 45 PERIODS
5. Demonstrate the knowledge of societal activity on the long- and short-term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyze effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

**TEXT BOOKS:**

**AZ5402 MATHEMATICAL FOUNDATIONS FOR DATA SCIENCE**

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Vector Spaces, Definition of Vector spaces, Subspaces, sums of Subspaces, Direct Sums, Span and Linear Independence, bases, dimension - Definition of Linear Maps - Algebraic Operations on L(V,W) - Null spaces and Ranges - Fundamental Theorems of Linear Maps - Representing a Linear Map by a Matrix- Invertible Linear Maps- Isomorphic Vector spaces-Linear Map as Matrix Multiplication-Operators-Products and Quotients of Vector Spaces.

**Suggested Activities:**
- Exploration on the usage of vector spaces and linear maps
- Solving a problem by choosing appropriate representation for the given data.

**Suggested Evaluation Methods:**
- Assignments on problem solving using vector space and linear maps
- Tutorials on vector space and linear maps

**UNIT II EIGENVALUES, EIGENVECTORS, AND INNER PRODUCT SPACES**

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**Suggested Activities:**
- Exploration on the usage of eigenvalues and eigenvectors
- External learning - different structures on norms and inner products
- Identifying the relationship between inner products and norms

**Suggested Evaluation Methods:**
- Assignments on problem solving using eigenvalues and eigenvectors
- Tutorials on inner products and norms

**UNIT III PROBABILITY, RANDOM PROCESS AND STATISTICAL METHODS**

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**Suggested Activities:**
- Demonstrating the probability distribution of different data sets.
- Exploring the correlations between the different features of data
• Identifying the use of statistical methods in data analysis

**Suggested Evaluation Methods:**
• Assignments on probability and random process
• Tutorials on statistical methods in data analysis

**UNIT IV  HIGH-DIMENSIONAL SPACE**

The Law of Large Numbers - The Geometry of High Dimensions - Properties of the Unit Ball - Generating Points Uniformly at Random from a Ball - Gaussians in High Dimension - Random Projection and Johnson-Linden Strauss Lemma Dimension - Separating Gaussians - Fitting a Spherical Gaussian to Data.

**Suggested Activities:**
• Exploring the Geometry of High Dimensions
• Application of Random Projection and Johnson-Linden Strauss Lemma

**Suggested Evaluation Methods**
• Assignments on high dimensional data representation and analysis
• Tutorials on Random Projection

**UNIT V  SINGULAR VALUE DECOMPOSITION**


**Suggested Activities**
• Exploring the Singular Value Decomposition
• Application of Singular Value Decomposition

**Suggested Evaluation Methods**
• Assignments on Singular Value Decomposition
• Tutorials on Best Rank-k Approximations

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
CO1: Find the basis and dimension of vector space and linear map
CO2: Obtain eigenvalues and eigenvectors of the data and represent them inner product space
CO3: Apply probability and random process concepts to in data analysis
CO4: Represent the large dimension data in high dimensional space and perform analysis
CO5: Apply Singular Value Decomposition on the data to simplify the problem
CO6: Demonstrate the use of mathematics in data science through a case study.

**TEXT BOOKS:**

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IT5403 OPERATING SYSTEMS L T P C 3 0 0 3

UNIT I INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES 9

Suggested Activities:
- Introduction to Linux and shell programming.
- External learning - Introduction to xv6: download, build, boot (in virtual machine if needed).
- Implement a user program in xv6 to print “Hello World!!”.
- Study and use of system calls in xv6: getpid, fork, clone, exit, wait.
- Study of the following files in xv6:
  - main.c[Bootstrap processor running, other CPU setup, starting running processes], syscall.h[system call numbers], syscall.c[system call handler] sysproc.c[system call definitions], proc.c[set up first user process, create new process, allocating process, exit of process, process states and scheduling], swtch.S[context switch], proc.h [per-CPU state and per-process state], vectors.S[trap handler], trapasm.S[build trap frame], trap.c[Interrupt Descriptor Table], traps.h[Interrupt constants]
- Exercises on Virtualization like the following may be given:
  - Given two C code snippets that compile and execute without any errors, queries like the following may be asked: If the given code snippets are run on a machine with a single CPU and a main memory of size 1 GB, what are the hardware resources that are being virtualized - Only CPU OR only memory OR both?
  - Writing a user program to check and print the state of a process (current/all/specified) in xv6.
  - Give two C code snippets (assuming that these compile successfully and APIs like fork(), exec(), and wait() never fails) and questions like the following may be given:
    (a) After program 1 is executed, how many processes are created?
    (b) After program 2 is executed, how many processes are created?
  - External learning - Mobile OS structure.
Suggested Evaluation Methods:
- Quiz on understanding of Linux and shell programming.
- Implementation evaluation of “Hello World!” user program.
- Quizzes on xv6 system calls, study files and other topics of the unit.
- Assignments to be appropriately evaluated.
- Assignments and implementation evaluation.

UNIT II  PROCESS SYNCHRONIZATION AND SCHEDULING


Suggested Activities:
- Add a new system call with parameters in xv6 and invoke it in user program.
- Create thread and implement multi threading using pthread library in any language.
- Implement at least one form of producer consumer problem in any language.
- Implement process synchronization using lock variable method in any language.
- Implement Dekker’s algorithms using thread in any language.
- Implement semaphores in any language.
- Computation of the response time and turnaround time when running three jobs of length 200 with the SJF, FIFO and RR (time–slice of 1) schedulers.
- Study of the following files in xv6: main.c [Starting running processes], vm.c [allocating space for scheduler processes], proc.h [process context and state], proc.c [scheduling], swtch.S [context switch]
- Study of the scheduling algorithm in xv6 and making appropriate changes in the Round Robin scheduler in xv6 to print the process id and process name during scheduling.
- Assignments on scheduling mechanisms.

Suggested Evaluation Methods:
- Implementation evaluation of system call in xv6 using the implemented user program.
- Implementation evaluation of multi-threading.
- Quiz on xv6 study files and other topics of the unit.
- Quiz to check the understanding of the scheduling concepts in xv6.
- Assignments to be appropriately evaluated.

UNIT III  FILE SYSTEM


Suggested Activities:
- Demonstration of various combined actions using system calls and file such as the followings: Is it possible to use file names only without using file descriptor (fd) or, given an
fd, is it possible to get the corresponding file name or can multiple directories “contain” the same file?

- Create a file in xv6 and perform read and write operations.
- Study the following files in xv6: file.c, sysfile.c [file creation, reading and writing].
- Change the existing xv6 file system to add high-performance support for small files. The basic idea is as follows: If one has a small file that can be indexed with only 13 direct data pointers, we use the 13th pointer as reserved for indirect data block as a direct data pointer, thus speeding up access to the small file, as well as saving some disk space.

Suggested Evaluation Methods:
- Checking the understanding of the file concepts in xv6.
- Quiz on xv6 study files and other topics of the unit.
- Assignment on xv6 to be appropriately evaluated.
- Implementation evaluation of small file problem in xv6.

UNIT IV MEMOR Y MANAGEMENT


Suggested Activities:
- Study files in xv6: umalloc.c and kalloc.c (kvalloc() [allocating space for kernel process], allocuvm() [allocating page tables and physical memory], deallocuvm() [deallocating physical memory], freem() [free physical memory page table].
- Practical - Implementation and use of functions malloc() and free() in xv6.
- Practical - Implementation of at least one of the page replacement policies.
- Assignments on computing page faults for LRU, FIFO and Optimal Page Replacement algorithms.
- Practical - Implementation of the program in any programming language to select free holes from given memory partitions using first-fit, best-fit, and worst-fit dynamic storage allocation strategies.

Suggested Evaluation Methods:
- Quiz on xv6 study files and other topics of the unit.
- Implementation evaluation of assignment in xv6 and other programs.

UNIT V I/O SYSTEMS AND STORAGE MANAGEMENT


- Suggested Activities:
  - Use I/O (open, read, write, ioctl) system calls in xv6.
  - External learning - Learn the differences between solid state drives and hard disk drive.
  - External learning - Understand the concepts of blocking and non-blocking I/O.
  - Practical - Write a chat program using blocking I/O (read/write) and non-blocking I/O using any language.
  - Practical - Write a program to perform contiguous, linked and indexed allocation strategies using any language.
Suggested Evaluation Methods:
- Quizzes on I/O and other concepts in xv6 and other topics of the unit.
- Implementation evaluation of the practical assignments.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Articulate the main concepts, key ideas, strengths and limitations of operating systems.
CO2: Analyze the structure and basic architectural components of OS.
CO3: Design various scheduling algorithms.
CO4: Understand various file management systems.
CO5: Design and implement memory management schemes.
Acquire a detailed understanding of various aspects of I/O management.

TEXT BOOK:

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AZ5401 ARTIFICIAL INTELLIGENCE

UNIT I ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING
Suggested Activities:
- AI Quiz (Paper Pen/Online Quiz)
- Introducing the concept of Smart Cities, Smart Schools and Smart Homes
- Developing a framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using informed search techniques and uninformed search techniques
- Simple program on informed search algorithm

Suggested Evaluation Methods:
- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT II
ADVERSARIAL SEARCH AND GAMES
Min-max Search, Heuristic Alpha-Beta Tree Search, Cutting of Search, Monte Carlo Tree Search - Optimal Decisions in Games: Alpha-Beta Pruning, Stochastic Games, Partially Observable Games, Card Game.

Suggested Activities:
- Developing a framework for real life activities such as searching techniques
- Developing algorithms for basic mathematical expressions using simple game program
- Simple program on tic-tac-toe game
- Simple program on 8 queen puzzles

Suggested Evaluation Methods:
- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT III
KNOWLEDGE, REASONING, AND PLANNING

Suggested Activities:
- Developing a framework for real life activities such as propositional theorem
- Developing algorithms for basic mathematical expressions using simple reasoning systems
- Simple program on first order logic method

Suggested Evaluation Methods:
- Quizzes on algorithm and basic python.
- Assignments on illustrative problems.
- Quizzes on simple python programs.
UNIT IV AI PLANNING AND NLP
Natural language processing – Language understanding models – NLP Syntax and Semantics – Introduction to Statistical NLP – Classical Planning – Types – Graph Plan and SAT plan – Partial Order Planning

Suggested Activities:
- Developing a framework for real life activities such as monitoring and planning.
- Developing algorithms for basic Boolean satisfiability
- Simple program m – Graph Plan

Suggested Evaluation Methods:
- Quizzes on Knowledge in AI
- Assignments on illustrative problems.
- Quizzes on simple python programs.

UNIT V ADVANCEMENTS AND APPLICATIONS IN AI

Suggested Activities:
- Development of Chatbot
- Study of popular recommendation systems

Suggested Evaluation Methods:
- Evaluation of programming exercises
- Quiz on recent trends
- Assignment on HMM problems

TOTAL: 45 PERIODS

COURSE OUTCOMES:
1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception and knowledge representation.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world Problems.
4. Analyze and illustrate how search algorithms play vital role in problem solving
5. Illustrate the construction of learning and expert system.
6. Discuss current scope and limitations of AI and societal implications

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AZ5403 DATA EXPLORATION AND VISUALIZATION L T P C 3 0 0 3

UNIT I THE FUNDAMENTALS OF EDA 9

Suggested activities:
1. Explore your dataset
2. Extract important variables and leave useless variables
3. Identify outliers, missing values, or human error

Suggested Evaluation Methods:
1. Assignments on exploratory data analysis

UNIT II EXPLORATORY DATA ANALYSIS 9
Significance of EDA - Comparing EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids for EDA - EDA with Personal Email - Data Transformation - Descriptive Statistics - Grouping Datasets Correlation - Time Series Analysis.

Suggested activities:
1. Identify the relationship(s), or lack of, between variables
2. Discover patterns and Use correlation analysis to identify linear relationships between two variables.
Suggested Evaluation Methods:
   1. Creating an application and exploring real time analysis

UNIT III  UNIVARIATE, BIVARIATE, MULTIVARIATE DATA ANALYSIS  9

Suggested activities:
   1. Practice using the qnorm function.
      Given a normal distribution with mean 650 and standard deviation 125. There exist two quantiles, the lower quantile q1 and the upper quantile q2, that are equidistant from the mean 650, such that the area under the curve of the normal between q1 and q2 is 80%. Find q1 and q2.
      Calculate the mean, variance, and the lower quantile q1 and the upper quantile q2, that are equidistant and such that the range of probability between them is 80%.
   2. Combine two of the techniques you've learned to visualise the combined distribution of cut, carat, and price.

Suggested Evaluation Methods:
   1. Creating an application and understanding different data visualization.
   2. Assignments of the problem

UNIT IV  DATA VISUALIZATION (2D / 3D)  9
Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text and Annotation - Customizing Ticks - Customizing Stylesheets - Three-Dimensional Plots - Geographic Data with Basemap - Visualization with Seaborn.

Suggested activities:
   1. Scatter Plot with Matplotlib
   2. Histogram with Plotnine (ggplot)
   3. Boxplot with Seaborn

Suggested Evaluation Methods:
   1. understanding 2D/3D data visualization with an application by a developmental model
   2. Assignments of the problem

UNIT V  INTERACTIVE DATA VISUALIZATION  9

Suggested activities:
   1. Emphasizing Fractions Using a Pie Chart
   2. Plotting X/Y Data with a Scatter Chart
   3. Add Magnitudes to X/Y Data with a Bubble Chart
   4. Add Controls and Define data Structure for Interactive Charts
   5. Integrate Charts to a web page and establish default style for the charts
6. Draw Composite charts and handle click events
7. Create Timeline chart
8. Visualize the Geographic data, incorporate label animation

**Suggested Evaluation Methods:**
1. Creating an interactive data visualization in a web page.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
- Understand the fundamentals of exploratory data analysis and its commonly used techniques.
- Apply statistical concepts to analyze data and explore the tools used for EDA.
- Perform multivariate data visualization and analysis.
- Interpret results of exploratory data analysis using stylesheets.
- Implement visualization techniques in web for applications.

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**Avg.**
LIST OF EXPERIMENTS:
1. Study Experiment – AI tools: Working and Installation
2. Write a program to implement heuristic search procedure.
3. Design a program to implement depth limited search
4. Write a program to implement water jug problem.
5. Program to implement A* / AO* algorithm.
6. Write a program to implement Bidirectional Search
8. Write a program to optimize Travelling Sales Person problem.
9. Write a program to implement search problem of 3 x 3 puzzles.
10. Write a program to implement Hangman game using python.
11. Write a program to implement tic tac toe game for O and X.
12. Implement a program to perform abstractive text summarization
13. Implement a program to perform extractive text summarization.
14. Design and implement a Chat bot application.
15. Mini Project for societal application.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
1. Implement simple PEAS descriptions for given AI tasks
2. Implement a program that can summarize the given text document.
3. Demonstrate the ability to solve problems using searching and backtracking
4. Ability to implement simple reasoning systems using either backward or forward inference mechanisms
5. Will be able to choose and implement suitable techniques for a given AI task

SOFTWARE:
Open-Source Software using Python

REFERENCES:
LIST OF EXPERIMENTS:
1) Generate the data quality report in terms of identifying missing values, irregular cardinality and outliers for an insurance company.
2) Descriptive feature identification for predicting a target feature by visualizing relationships.
3) Data preparation for Exploration using normalization, binning and sampling methods.
4) Design and create data visualizations.
5) Conduct exploratory data analysis using visualization.
6) Craft visual presentations of data for effective communication.
7) Use knowledge of perception and cognition to evaluate visualization design alternatives.
8) Design and evaluate color palettes for visualization based on principles of perception.
9) Apply data transformations such as aggregation and filtering for visualization.
10) Develop data exploration and visualization for an application - Mini Project

SOFTWARE:
Python data exploration with Pandas
Data Exploration and visualization in R

COURSE OUTCOMES:
- Create data visualization by predicting relations among data
- Perform EDA using visualization techniques.
- Perform multivariate data visualization and analysis.
- Implement visualization using principles of perception.
- Implement visualization techniques in web for applications
UNIT I  MACHINE LEARNING BASICS

Suggested Activities:
- Discussion on application domains of machine learning in data analytics.
- External Learning – Study of tools for data analytics.

Suggested Evaluation Methods:
- Quiz on machine learning techniques and applications.
- Implementation of machine learning techniques with Python libraries.

UNIT II  REGRESSION & CLASSIFICATION

Suggested Activities:
- Discussion on importance of supervised learning methods and applications.
- Seminar on Regression techniques (Lasso, Elastic Net, etc.) and Decision tree based design approaches.

Suggested Evaluation Methods:
- Quiz on applications of decision tree, and SVM algorithms.
- Implementation of ML techniques for classification problems.

UNIT III  ENSEMBLE, CLUSTERING AND DIMENSIONALITY REDUCTION

Suggested Activities:
- Group discussion on ensemble learning techniques and its limitations.
- Case study of evaluation metrics of learning algorithms.
- Implementation of clustering algorithms.

Suggested Evaluation Methods:
- Implementation of ensemble learning methods in Python.
UNIT IV PROBABILISTIC LEARNING MODEL
Bayesian Learning - Naive Bayes Algorithm - Introduction to Graphs – Bayesian Belief Networks - Inference in Graphical Models - Markov Chain – Markov Model - Hidden Markov Models – Inference – Learning - Generalization – Undirected Graphical Models -

Suggested Activities:
- Discussion on importance of graphical models
- Implementation of Naïve Bayes Algorithm

Suggested Evaluation Methods:
- Assignment on Inference
- Quiz on Bayesian Belief Network

UNIT V REINFORCEMENT LEARNING & ANN
Overview of Reinforcement Learning - Components of Reinforcement Learning - Markov decision process - Model Based Learning - Model Free Learning - Q Learning – Artificial Neural Networks – Structure and Activation functions – Perceptron – Multi Layer Perceptron - Back Propagation – Gradient descent training - Radial Basis function Neural Network

Suggested Activities:
- Case study on application of artificial neural networks in image/video data.
- Discussion on different ANN based ML methods.

Suggested Evaluation Methods:
- Implementation of basic ANN techniques
- Quiz on future applications of ANN.
- Assignments on reinforcement learning techniques for the real-time applications.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the basics of machine learning.
2. Solve analytical problems with relevant mathematics background knowledge.
3. Explain testing and evaluation machine learning algorithms.
4. Understand ANN model apply knowledge in data analytics.
5. Explore the knowledge of unsupervised learning in data analysis.
6. Apply ML techniques to various real time applications.

TEXT BOOKS:

REFERENCES:
UNIT I  INTRODUCTION AND APPLICATION LAYER 9

Suggested Activities:
- In-class activity - Solving problems on performance metrics.
- In-class activity - HTTP problems.
- Accessing HTTP and SMTP server through Telnet.
- External learning - HTTP/DNS format using a tool like Wireshark.
- External learning - POP3 and IMAP protocols of email application.

Suggested Evaluation Methods:
- Quiz on Wireshark.
- Quiz on POP3 and IMAP.
- Assignment problems different protocols.

UNIT II  TRANSPORT LAYER 9

Suggested Activities:
- Flipped Classroom on UDP Applications.
- External learning - Wireshark for UDP, TCP packet formats.
- External learning - Transport for Real Time Applications.
- External learning - Understanding RFCs.
- Assignments on flow control analysis in class.

Suggested Evaluation Methods:
- Quiz on UDP applications.
- Quiz on real time transport protocols.
• Discussion/assignment on RFC.
• Interpreting Wireshark output.

**UNIT III  NETWORK LAYER**


**Suggested Activities:**
- In-class activity - IP addressing.
- External learning - IPV4 Packet Format using Wireshark.
- In-class activity - Subnetting for different scenarios.
- Flipped classroom on CIDR.
- External learning - Ping and trace-route commands.
- Mini-project on the implementation of a protocol based on an RFC.

**Suggested Evaluation Methods:**
- Quiz on CIDR.
- Check ability to use commands.

**UNIT IV  ROUTING**


**Suggested Activities:**
- In-class activity - Distance Vector Routing, Link State Routing.
- External learning - RIP, OSPF packet formats.
- Assignment on Link state routing for different network graphs.
- In-class activity - Error Detection and Correction.
- Flipped classroom on IPV6.
- External learning - Study on global IP address assignment.

**Suggested Evaluation Methods:**
- Quizzes on RIP, OSPF packet format.
- Quiz on IPv6.

**UNIT V  DATA LINK AND PHYSICAL LAYERS**


**Suggested Activities:**
- In-class activity - Problems on encoding techniques.
- External learning - Virtual LAN, Wireless LAN (802.11) formats.
- Flipped Classroom on recent developments in transmission media.
- Design a protocol for some application.
- Trace the end-to-end flow of packets through the network.
Suggested Evaluation Methods:
- Quizzes on VLAN and 802.11 formats.
- Presentation/Implementation of design.
- Demonstration of RFC implementation project.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1: Highlight the significance of the functions of each layer in the network.
2: Identify the devices and protocols to design a network and implement it.
3: Build network applications using the right set of protocols and estimate their performances.
4: Trace packet flows and interpret packet formats.
5: Apply addressing principles such as subnetting and VLSM for efficient routing.
6: Explain media access and communication techniques.

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AZ5502 DATA ANALYTICS L T P C
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UNIT I  INTRODUCTION TO DATA ANALYTICS AND BIG DATA
Overview of Data Analytics: Types of Data Analysis – Steps in Data Analysis Process – Data Repositories – ETL process – Roles, Responsibilities and Skill Sets of Data Analysts – Data Analytic

**Suggested Activities:**
- Case studies on big data applications.
- Challenges of big data in real-time and domain-specific problems.
- Demonstration on data analytics tools.

**Suggested Evaluation Methods:**
- Assignment on case studies related to applications of big data analytics.
- Group presentation on big data applications with societal need.
- Quizzes on big data and data analytics terminologies, data analytic tools and big data applications.

**UNIT II  DESCRIPTIVE AND INFERENTIAL STATISTICS**


**Suggested Activities:**
- Practicing numerical problems based on descriptive and inferential statistics.
- Demonstration of descriptive analysis using Python.
- Demonstration of data visualization in Python.

**Suggested Evaluation Methods:**
- Assignment on data distribution and description using open-source tools.
- Group Presentation on description and inference of data in real world applications.
- Quiz on descriptive and inferential statistics.

**UNIT III  EXPLORATORY DATA ANALYTICS**


**Suggested Activities:**
- Solving problems in univariate, bivariate and multivariate analysis.
- Demonstration on Graph Data using python.
- Demonstrate PCA and KPCA using Iris data set in Python.

**Suggested Evaluation Methods:**
- Assignment on Multivariate analysis of numeric and categorical attributes.
- Group Presentation on Kernel methods.
- Quiz on High dimensional data.
UNIT IV DATA ANALYTICAL FRAMEWORKS


Suggested Activities:
- Case studies on data analytical frameworks with real-time applications.
- Hands-on session for Installation and configuring Hadoop and MapReduce.
- Develop algorithms with Map Reduce framework.

Suggested Evaluation Methods:
- Practical – Programming assignments in Hbase, MongoDB and CouchDB.
- Quiz on Hive, Sqoop and Apache Drill.
- Mini Project (Group) – Collect the real-time data and store it in any one of the NoSQL databases. Implement analytical techniques using Map-Reduce Tasks and Visualize the results.

UNIT V BUSINESS ANALYTICS


Suggested Activities:
- Case studies on real-time applications related to business analytics.
- Demonstration of business analytical tools.
- Demonstration of data analytics in business applications using python.

Suggested Evaluation Methods:
- Assignment on Framework for Business Analytics.
- Quiz on Business data analytics methods.
- Group presentation on the real-time applications.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student will be able to:
1. Understand the real-world business problems and model with analytical solutions.
2. Analyze an analytical problem with relevant statistical knowledge.
3. Apply all data preprocessing techniques on high dimensional data.
4. Explore different big data frameworks for programming, storage and statistical analysis.
5. Apply the appropriate analytical solutions for business applications.
6. Implement data analytics and data visualization using Python.

TEXT BOOKS:

2. Rayan Wali&Quot;,” A Practical Guide to AI and Data Analytics”, Independently Published, 2022.

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AZ5503   OPTIMIZATION TECHNIQUES.  L T P C

UNIT I  CLASSICAL OPTIMISATION TECHNIQUES  9

Suggested Activities
- Exploration on the usage of optimization techniques
- Solving a problem by choosing appropriate representation for the given data.

Suggested Evaluation Methods
- Assignments on problem solving using constraints
- Tutorials on optimization problems and constraints

UNIT II  LINEAR MODELS  9
Suggested Activities
- External learning – LPP based applications
- Solving problems in LPP

Suggested Evaluation Methods
- Assignments on problem solving using LPP methods
- Tutorials on Operations Research problems

UNIT III: NON LINEAR MODELS

Suggested Activities
- Exploration on the usage of non-linear models
- Implementation of different direct and indirect methods of optimization

Suggested Evaluation Methods
- Assignments on non-linear models
- Tutorials on direct and indirect methods

UNIT IV  OPTIMIZATION TECHNIQUES FOR DATA SCIENCE
Gradient Descent (flow) -Projected Gradient (white-box adversarial attack) -Subgradient (svm) - Proximal Gradient (lasso) -Conditional Gradient (recommendation system) - Coordinate Gradient (graph clustering) -Lower Bound I - Acceleration (total variation denoising) - Mirror Descent (reinforcement learning) - Smoothing (robust svm) - Proximal Average (federated learning) -Splitting (robust PCA).

Suggested Activities
- Implementation of data science application using optimization techniques
- Analysis of algorithms based on optimization using suitable dataset

Suggested Evaluation Methods
- Assignments on optimization techniques for data science
- Tutorials on data science optimization techniques

UNIT V MODERN OPTIMIZATION ALGORITHMS

Suggested Activities
- Implementation of modern optimization algorithms in real world problems
- Analysis of modern algorithms based on optimization using suitable dataset

Suggested Evaluation Methods
- Assignments on optimization algorithms
- Tutorials on analysis of modern optimization algorithm.
OUTCOMES:
Upon completion of the course, the students will be able to
1. Understand the use of optimization techniques
2. Solve problems using linear optimization techniques
3. Use appropriate non linear optimization techniques to solve the problem
4. Apply the optimization techniques for data science applications
5. Explore the contemporary optimization approaches

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AZ5511  MACHINE LEARNING LABORATORY  L T P C  0 0 4 2

LIST OF EXPERIMENTS:
1. Implement Naive Bayes learning algorithm for a sample training data set.
2. Implement a linear regression method.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4. Write a program to handle overfitting.
5. Implement SVM algorithm for a given data set.
6. Implement Bagging, boosting, and DECORATE algorithms with performance evaluation mechanisms.
7. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test
the same using appropriate data sets.
8. Implement facial recognition application with artificial neural network
9. Choose best machine learning algorithm to implement online fraud detection
10. Write a program to implement k-Nearest Neighbour algorithm.
11. Implement a k-means partitional clustering
12. Implement sentiment analysis using random forest optimization algorithm.

TOTAL : 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the implementation procedures for the machine learning algorithms.
2. Design Python/R/Java programs for various learning algorithms.
3. Implement ensemble and reinforcement learning techniques for a given data set and evaluate them.
4. Implement artificial neural network for a given application and dataset.
5. Identify and apply machine learning algorithms to solve real world problems.

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AZ5512 DATA ANALYTICS LABORATORY L T P C
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LIST OF EXERCISES:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages. Read data from text file, excel and the web.
2. Choose a dataset from Kaggle and explore various commands for descriptive analytics.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis on the dataset.
4. Perform Z-test, T-test & ANOVA on the dataset.
5. Perform data pre-processing operations handling missing data and normalization on the dataset.
7. Perform Bivariate analysis: Linear and logistic regression on the dataset.
8. Perform Multiple Regression analysis on the dataset.
9. Load a graph dataset and perform basic analysis such as calculating node degree centrality, identifying important nodes using between-ness centrality.
10. For the graph dataset chosen in previous question, find communities using graph clustering.
11. Implement page rank/HITS on large scale graph datasets.
12. Load a dataset and measure the regression performance using different kernel functions.
13. Perform kernel matrix operations on the dataset chosen
15. Choose any one business analytic tool (MS Excel/Power BI) and perform statistical descriptive and inference analytics.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Have skills in developing and executing analytical procedures in python.
2. Explore data and understand the distribution of data.
3. Develop, implement and deploy predictive models using regression.
4. Implement simple to complex data modeling with graph datasets.
5. Implement programs using kernel functions and tune models.
6. Have practical experience in carrying out descriptive and inferential statistics in a business analytical tool.

MAPPING of CO’s with PO’s and PSO’s

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AZ5601 DEEP LEARNING TECHNIQUES L T P C
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UNIT I BASICS OF NEURAL NETWORK
Artificial Neuron - McCulloch Pitts units and Thresholding logic - Perceptron learning algorithm and Convergence - Linear separability - Feedforward Networks - Activation and Loss Functions.

Suggested Activities
- Implement a perceptron learning algorithm
- Design an artificial neural using thresholding logic and other activation functions
- Analyze convergence of feed forward networks

Suggested Evaluation Methods
- Coding challenges to complete during class time
• Assignment to implement and train the network using appropriate technique and tools
• Quizzes and test

UNIT II INTRODUCTION OF DEEP NEURAL NETWORKS

Suggested Activities:
• Implement a multilayer perceptron
• Experiment with different optimization methods
• Test with regularization techniques

Suggested Evaluation Methods:
• Coding Assignments – Vanishing and Exploding GD
• Tutorial on Multilayer perceptron and optimization methods
• Quizzes Regularization – Dropout

UNIT III CONVOLUTIONAL NEURAL NETWORKS

Suggested Activities:
• Flipped classroom on CNN architectures
• External learning – concept of convolution and pooling layer
• Exploring on Transfer learning

Suggested Evaluation Methods:
• Quizzes on CNN architectures
• Hands-on coding Assignments on image classification using transfer learning

UNIT IV RECURRENT NEURAL NETWORKS
Sequence Modelling –Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - Deep Recurrent Networks, Recursive Neural Networks - Long Short-Term Memory Networks – Other Gated RNNs

Suggested Activities:
• Implement and train a simple RNN
• Build a sequence-to-sequence model
• Use a pretrain RNN model and analyse their performance on different sequence modelling task.
• Implement an LSTM network.

Suggested Evaluation Methods:
• Evaluate the accuracy of the RNN models prediction on a test dataset
• Comparison of architectures: LSTM, GRU, RNN on a test dataset
UNIT V AUTOENCODERS AND GENERATIVE MODELS


Suggested Activities:
- Discussion on Building and training autoencoders
- Understand the math behind the generative models

Suggested Evaluation Methods:
- Assignment problems on Directed Generative nets and Generative adversarial networks
- Quizzes on autoencoders

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to:
1. Understand fundamental neural network concepts, including activation functions and loss functions.
2. Familiarize with different optimizers in machine learning and choose the appropriate one.
3. Design and implement deep learning architectures, such as CNNs, RNNs, autoencoders and Generative models.
4. Implement deep learning models using libraries like TensorFlow or PyTorch.
5. Apply deep learning techniques to real-world problems, with awareness of ethical considerations.

TEXT BOOKS

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TEXT BOOKS

REFERENCES

MAPPING of CO’s with PO’s and PSO’s
UNIT I DIGITAL IMAGE FUNDAMENTALS AND LOW-LEVEL PROCESSING 9

Suggested Activities:
- Discussion on different colour models and their applications.
- Study of OpenCV libraries for image/video applications.
- Demonstration of offline/online tools for image enhancement/restoration/histogram processing.

Suggested Evaluation Methods:
- Quizzes on various image capturing devices and related techniques.
- Practical – Programming assignments on basic image processing techniques.

UNIT II DEPTH ESTIMATION AND MULTI-CAMERA VIEWS 9

Suggested Activities:
- Flipped classroom on camera vision and calibration in computer vision.
- Discussion on 3-D image/video capturing, analysis, and projection techniques.

Suggested Evaluation Methods:
- Quizzes on applications of stereovision and homography.
- Group discussion on handling outliers in image/video data.

UNIT III FEATURE EXTRACTION AND SEGMENTATION 9
Edges - Canny, LOG, DOG - Line detectors (Hough Transform) – Corners: Harris and Hessian Affine - Orientation Histogram, SIFT, SURF, HOG, GLOH - Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Markov Random Fields - Texture Segmentation

Suggested Activities:
- Implementation of line/corner detection techniques.
- Discussion on practical usage of SIFT and SURF based features.
- Flipped classroom on various feature reduction methods.

Suggested Evaluation Methods:
- Quizzes on feature engineering in video analytics.
- Group discussion on different fundamental transformation techniques in image/video data.
- Practical – Programming assignments on filtering techniques.

UNIT IV MOTION ANALYSIS AND TRACKING 9

Suggested Activities:
- Python program to display optical flow of a given video data.
- Implementation of Kalman filter for object tracking in video data.
- External learning – Case study of developments in computer vision.

Suggested Evaluation Methods:
- Quizzes on various real time applications of computer vision.
• Group discussion on future apps. in computer vision to solve the real-world problems.

UNIT V OBJECT RECOGNITION AND SCENE ANALYSIS

Suggested Activities:
• Discussion on applications of object detection and tracking.
• Flipped classroom on challenges and approaches in human face detection and recognition.

Suggested Evaluation Methods:
• Assignments on applications of deep learning in vision based applications.
• Practical – Programming assignments on object detection/recognition techniques.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Describe the concepts related to Image formation and processing.
2. Compare the concepts related to feature detection, matching and detection.
3. Understanding feature based alignment and motion estimation.
5. Perform image based rendering and recognition.

TEXT BOOKS:

REFERENCES:
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

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UNIT 1 FOUNDATIONS OF IoT AND CLOUD

Suggested Activities
- Interactive lectures and discussions on enabling technologies
- Group projects exploring IoT and M2M proprietary protocols
- Case study analysis on designing IoT-based ecosystems

Suggested Evaluation Methods
- Quizzes and discussions on IoT enabling technologies (WSN, Cloud and Big Data).
- Assignments on IoT and M2M proprietary protocols
- Group presentations on case study analysis and design

UNIT II DEVELOPING IoT END DEVICES
Microprocessors vs Microcontrollers—Open-source hardware movement—Software Development Lifecycle (SDLC) for embedded systems—Arduino IDE—Raspberry Pi—Python, and related packages—Edge Computing and IoT: Concepts and use cases—Integration of IoT devices with cloud platforms

Suggested Activities
- Interactive lectures on open-source hardware and SDLC for embedded systems
- Workshops exploring various IoT development platforms and tools
- Guided projects on developing IoT applications using Arduino and Python

Suggested Evaluation Methods
- Quizzes on open-source hardware and SDLC for embedded systems
- Assignments on IoT development platforms and tools such as Atmega Microcontrollers, Cypress Pioneer and NXP Freedom
- Practical exams on developing IoT applications

UNIT III IoT PROTOCOLS

Suggested Activities
- Lectures and discussions on the role of IPv6 in IoT-based systems
- Hands-on workshops exploring various IoT protocols and software tools such as Coap and MQTT.
- Case study analysis of IoT reference models (e.g., Cisco, IBM)

Suggested Evaluation Methods
- Assignments on IoT protocol implementation and software tools
• Quizzes on IPv6 and IoT protocols (CoAP and MQTT)
• Group presentations on IoT reference model analysis

UNIT IV CLOUD OFFERINGS

Suggested Activities
• Interactive lectures on cloud models and types of cloud services
• Flipped classroom on using Django and other IoT cloud platforms
• Group projects on implementing IoT solutions using cloud offerings

Suggested Evaluation Methods
• Quizzes on cloud models and IoT cloud platforms
• Assignments on implementing IoT solutions using cloud offerings

UNIT V DATA ANALYTICS FOR IoT

Suggested Activities
• Lectures and discussions on popular machine learning algorithms (both supervised and unsupervised) and tools
• Flipped Classroom on data processing techniques (e.g., MapReduce)
• Guided projects on data analytics for IoT applications

Suggested Evaluation Methods
• Assignments on machine learning algorithms and tools
• Quizzes on data processing techniques and tools
• Group presentations on IoT analytics projects

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the enabling technologies and reference models of IoT.
3. Apply appropriate protocols in various parts of IoT based systems.
4. Understand Big Data tools and technologies and apply them in IoT based systems.
5. Design and deploy IoT based systems and connect
6. Design IoT systems for various real time applications.

TEXT BOOKS:

REFERENCES:

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AZ5611 DEEP LEARNING LAB L T P C 0 0 4 2

EXPERIMENTS
1. Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias and threshold.
   a. AND logic function
   b. OR logic function
   c. NOT logic function
   d. NOR logic function
   e. XOR logic function
2. Write a program to build a logistic regression classifier with a Neural Network mindset. Consider following guidelines.
   a. Consider any convenient dataset (Cats dataset etc.) and pre-process the dataset.
   b. Define the appropriate model structure.
   c. Evaluate the model performance.
   d. Analyse the obtained results
3. Design a neural network (NN) model with one hidden layer for classification problems. Use Planar data set or any other suitable data set
   a. Implement a 2-class classification neural network with a single hidden layer.
   b. Use units with a non-linear activation function, such as tanh.
   c. Compute the cross-entropy loss.
   d. Implement forward and backward propagation.
   e. Evaluate the model performance.
   f. Analyse the results.
4. Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable
Perform Exploratory Data Analysis
   a. Prepare dataset
   b. Build MLP model
   c. Evaluate Model performance
   d. Predict for test data
5. Implement the Face recognition using CNN
6. Implement a transfer learning concept for image classification
7. Implement an auto encoder for image denoising
8. Implement a dialogue generation using LSTM with attention mechanism
9. Implement an opinion mining in RNN
11. Image augmentation using GANs
12. Mini project: Real world problems

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
   1. Perform different pre-processing operations on structured or unstructured data
   2. Design neural network for various learning problems.
   3. Demonstrate binary as well as multi-class classification problems.
   4. To design and implement deep learning models for real time problems
   5. Interpret the model results and analyse the performance of the models.

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AZ5612  IoT AND CLOUD LAB  L T P C  0 0 4 2

EXPERIMENTS
   1. Develop an Arduino sketch for a blinking LED.
   2. Develop an Arduino sketch to control the LED brightness, including fading in and out.
   3. Develop an Arduino sketch to calibrate a sensor by tracking the highest and lowest sensor readings during startup.
   4. Develop an Arduino sketch to control the LED blink rate using a variable resistor as an analog input.
   5. Develop an Arduino sketch to detect vibrations using a piezo element.
   6. Develop a Python program to control an LED using Raspberry Pi.
   7. Develop a Python program to interface an LED with a switch using Raspberry Pi.
8. Develop an application to store big data in HBase or MongoDB using Hadoop or R.
9. Explore IoT cloud platforms: Create and deploy an IoT application using platforms like IBM Watson, AWS IoT, or Azure IoT Hub.
10. Implement IoT protocols: Develop a Python program using CoAP or MQTT to send sensor data from Raspberry Pi to a cloud platform.
11. Perform data analytics on IoT data: Analyze and visualize IoT data using Python libraries or cloud-based tools like Google Data Studio.
12. Investigate IoT security: Explore encryption, authentication, and authorization techniques for IoT devices and applications.
13. Mini-project: Design, develop, and present an end-to-end IoT solution using the skills acquired from the lab sessions.

TOTAL: 60 PERIODS

Course Outcomes:
On completion of the course, the students will be able to:
1. Use arduino/ raspberry pi and various sensors to build simple IoT experiments
2. Use wireless peripherals for exchange of data and use of Cloud platform to upload and analyse any sensor data
3. Use of Devices, Gateways and Data Management in IoT , to build a complete, working IoT system
4. Configure various virtualization tools such as Virtual Box, VMware workstation.
5. Design and deploy a web application in a cloud environment.
6. Manipulate large data sets in a parallel environment using Hadoop, MongoDB

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AZ5613     SOCIALLY RELEVANT PROJECT LABORATORY     L T P C
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Students are expected to take up problems that would directly benefit society and design and implement an IT based solution for the problem, based on the courses undertaken up to that semester. The domains of the problems may reach out to sectors like but not limited to Energy, Education, Material, Environment, Telecommunications, Defense, Healthcare, Banking, Entertainment and Agriculture. The societal value of the project is to be evaluated based on the need of the hour and request from stakeholders. The evaluation of the project would be based on the usefulness of the problem statement, formulation of the problem, stakeholders need, and the usage statistics of the solution and the technical merit of the solution.
The project design, development and testing phases can be as shown below:

**REQUIREMENTS ENGINEERING PHASE:**
- Problem identification.
- Feasibility study of domain.
- Requirement elicitation and analysis.

**DESIGN PHASE:**
- Architectural design.
- UI design.
- Component Design.
- Database design.

**IMPLEMENTATION PHASE:**
- Coding in a suitable language using necessary platforms and tools.

**TESTING AND VALIDATION PHASE:**
- Component Testing
- System Testing
- Acceptance Testing

**DOCUMENTATION:**
- Report Generation

**TOTAL:** 30 PERIODS

**COURSE OUTCOMES (COs)**

Upon successful completion of the course, the student will reliably demonstrate the ability to:

- **CO1.** Analyze social problems and provide IT based technical solutions in order to benefit society.
- **CO2.** Design, develop and implement solutions for social problems.
- **CO3.** Develop innovative technical solutions of social relevance.
- **CO4.** Design, develop and implement standard solutions to social problems.
- **CO5.** Apply Software engineering methodologies.
- **CO6.** Evaluate the solution based on usefulness, effectiveness, and user satisfaction.

**REFERENCES:**
1. [https://www.niti.gov.in/](https://www.niti.gov.in/).
2. [https://www.sih.gov.in/](https://www.sih.gov.in/).

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UNIT I        INTRODUCTION

Suggested Activities:
- Discussion on applications of text mining.
- Case study on text preprocessing and feature extraction techniques.

Suggested Evaluation Methods:
- Quiz on text processing tools.
- Program assignment of feature extraction and analysis.

UNIT II        TEXT CATEGORIZATION AND CLUSTERING

Suggested Activities:
- Flip classroom on text categorization.
- Case study on machine learning based chatbots.

Suggested Evaluation Methods:
- Quiz on probabilistic theory in text processing.
- Program assignment on text classification and clustering for real-time applications.

UNIT III        BASIC CONCEPTS IN SPEECH PROCESSING

Suggested Activities:
- Discussion on speech production and classification.
- Case study on application of digital signal processing in speech production and classification.

Suggested Evaluation Methods:
- Assignment on design of filter bank.
- Program assignment STFT and LPC methods.

UNIT IV        FEATURE EXTRACTION IN SPEECH
Suggested Activities:
- Discussion on fundamentals of feature extraction and analysis in speech data.
- Case study on applications of LPC, PLP, MFCC, etc. in speech processing.

Suggested Evaluation Methods:
- Quiz on speech processing tools.
- Program assignment on feature extraction and analysis in speech data.

UNIT V SPEECH MODELING AND RECOGNITION

Speech Recognition: Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – Ngrams, context dependent sub-word units-Gaussian Mixture Models (GMMs) for acoustic modeling.

Suggested Activities:
- Flip classroom on speech modeling and recognition.
- Case study on speech recognition based on traditional and machine learning methods.

Suggested Evaluation Methods:
- Assignment on application of speech modeling techniques.
- A mini project on speech-to-text and text-to-speech conversion.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to
1. Identify the different features that can be mined from text and web documents.
2. Understand classification and clustering of text data.
3. Understand basics of digital speech processing.
4. Explore features in speech data for application development.
5. Apply concepts in speech recognition.
6. Perform speech analysis for different applications.

TEXT BOOKS:

REFERENCES:

MAPPING of CO's with PO's and PSO's

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CO: Course Objectives
PO: Program Outcomes
PSO: Program Specific Objectives
UNIT I  INTRODUCTION TO SECURITY AND NUMBER THEORY  9

Suggested Activities:
- In-class activity - Practice cryptanalysis of classical cryptography and break the classical algorithms using cryptographic attack.
- In-class activity - Solve modular exponentiation and multiplicative inverse using Fermat and Euler theorem.
- Practical - Classical cryptography algorithms using Cryptool.

Suggested Evaluation Methods:
- Assignments on cryptanalysis of classical cryptography, additive Inverse, Multiplicative Inverse, and modular exponentiation using the theorem.
- Quiz on classical cryptography and number theory.
- Demonstration of the classical cryptography algorithms using Cryptool.

UNIT II  SYMMETRIC CRYPTOGRAPHY  9

Suggested Activities:
- Explain the importance of key size and explore some examples with brute force attack to break the key.
- Demonstrate the working of DES and AES algorithms using CrypTool.
- Demonstrate various cryptographic attacks on DES and AES.

Suggested Evaluation Methods:
- Assignments on key generation, linear and differential cryptanalysis of symmetric cryptography.
- Quiz on modes of operation and internal structure of DES and AES.

UNIT III  ASYMMETRIC KEY CRYPTOGRAPHY  9
Suggested Activities:
- Highlight the mathematics behind RSA, Diffie-Hellman Key exchange and Elliptic Curve Cryptography.
- Demonstrate the Hash code generation using MD5 and SHA 256 algorithm.
- Practical - Verify the Message Integrity using Hashing Techniques such as MD5 and SHA256.
- Case studies on Quantum and Threshold Cryptography.

Suggested Evaluation Methods:
- Assignments on RSA and ECC generation for encryption and decryption process.
- Quiz on mathematics behind the public key algorithms, Quantum, and Threshold Cryptography.

UNIT IV SECURITY APPLICATIONS


Suggested Activities:
- Case studies on understand the components of X.509 Certificate
- Demonstrate IP security and configure VPN connection.
- Implement the SSL/TLS in Web Server for a Web Application.

Suggested Evaluation Methods:
- Assignment on configuration of IP security and VPN connection in networks
- Quizzes on Key Management, SSL, TLS

UNIT V SYSTEM SECURITY


Suggested Activities:
- Teaching with case studies: access control and cloud security.
- Configure the Access Control List and use firewall, mitigate DoS attack.
- Understand the safety measures during the implementation of security in WLAN.
- Simulate the importance of various security standards in WLAN.

Suggested Evaluation Methods:
- Assignments on buffer overflow, malicious software, and types of IDS.
- Quizzes on firewall generation, WLAN security and cloud security.

COURSE OUTCOMES (COs)

On completion of the course, the students will be able to

CO1. Apply the basic security algorithms and policies required for a computing system.
CO2. Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.
CO3. Identify any network security issues and resolve the issues.
CO4. Manage the firewall and WLAN security.
CO5. Evaluate the system related vulnerabilities and mitigation.
CO6. Design secured web applications in real-time.
TEXTBOOKS:

REFERENCES:

MAPPING of CO’s with PO’s and PSO’s

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AZ5711 INFORMATION SECURITY LABORATORY L T P C 0 0 4 2

LIST OF EXPERIMENTS
The following exercises are based on cryptographic algorithms, cryptanalysis. They can be implemented using any Programming Language.

1. Implement basic mathematical requirements for cryptography.
2. Write a program to perform encryption and decryption of classic cryptosystems. Perform cryptanalysis using Brute-force Attack.
3. Write a program to demonstrate symmetric key encryption process using DES and AES algorithm (academic versions). Also perform cryptanalysis using CCA, CPA.
4. Write a program to implement RSA algorithm and demonstrate the key generation and encryption process and analyze the same using factorization attack.
5. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.
6. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like kali Linux.
7. Study and exploration of Wireshark tool
   a. To analyze network traffic for various protocols, e.g. ping, DNS and telnet.
   b. To learn about setting up ssh keys and configure the ssh client.
c. To verify whether the data is encrypted or not.
8. Study and exploration of Metasploit tool to learn about cracking hashed files in Windows environment.
9. Configure a firewall on Ubuntu platform.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)
Upon successful completion of the course, the student will reliably demonstrate the ability to:

CO1. Attain mathematical knowledge required for cryptography.
CO2. Implement specific encryption/decryption algorithms meant for Confidentiality, Integrity, and Authentication and to perform security analysis of the same by implementing cryptanalysis.
CO3. Analyze the vulnerabilities in any application using penetration testing.
CO4. Explore and perform network analysis using various networking tools.
CO5. Configure a firewall.
CO6. Develop a Security system for an application

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LIST OF PROFESSIONAL ELECTIVES

AZ5001 SERVICE ORIENTED ARCHITECTURE. L T P C
3 0 0 3

UNIT I INTRODUCTION TO WEB SERVICES 9

Suggested Activities
- XML processing
- Exploring the structure of SOAP, WSDL and UDDI
- RESTful web services

Suggested Evaluation Methods
- Implementing XML, DOM and SAX
- Programming exercises
UNIT II  SOA BASICS

Suggested Activities
- Applications of SOA
- Identifying simple services based on SOA

Suggested Evaluation Methods
- Application based comparison

UNIT III  SOA ANALYSIS AND DESIGN
Need for models - Principles of service Design –Reuse, Integration, Agility Design of Activity Services (or Business Services) -Illustration Design of Data Services, Design of Client Services, Design of Business Process Services, Illustration – Loan Approval Business Process, Explanation of Loan Approval Process

Suggested Activities
- Study on various service design
- SOA best practices case studies

Suggested Evaluation Methods
- Quiz on service design principles

UNIT IV  INTRODUCTION TO ENTERPRISE ARCHITECTURE (EA)

Suggested Activities
- Case study on SOA EA integration

Suggested Evaluation Methods
- Assignment on SOA tools

UNIT V  APPLICATION OF SOA
Big Data and SOA: Concepts, Big Data and its characteristics, Technologies for Big Data, Service-orientation for Big Data Solutions - AI in service-oriented software design

Suggested Activities
- External learning on AI and SOA
- Analysis on SOA for Big Data

Suggested Evaluation Methods
- Assignments on applications of SOA

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the students will be able to
1. Design a web service application
2. Articulate the main concepts, key technologies, strengths and limitations of SOA
3. Develop the ability to understand and use the SOA Technologies and delivery
4. Develop and design Enterprise architecture
5. Perform SOA based analytics and relate with AI.

TEXT BOOK:
3. Service Oriented Architecture by IBM ICE Publications

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AZ5002    GPU ARCHITECTURE AND PROGRAMMING    L T P C
3 0 0 3

UNIT I    GPU ARCHITECTURE

Suggested Activities:
- Flipped class on evolution of GPU.
• External learning – GPU architecture.

Suggested Evaluation Methods:
• Quizzes on GPU.
• Group discussion on GPU vs. SIMD

UNIT II GPU PROGRAMMING: CUDA
CUDA’s programming model: threads, blocks, and grids - CUDA’s execution model: streaming multiprocessors and warps - CUDA compilation process - Memory hierarchy - Optimization of CUDA applications - Graphs - Warp functions - Dynamic parallelism - Debugging CUDA programs.

Suggested Activities:
• Flipped class on parallel programming.
• Practical – Download the CUDA toolkit and setup the CUDA environment.
• Practical – Write simple CUDA code and vary the parameters to understand the concept of threads, blocks and grids

Suggested Evaluation Methods:
• Evaluation of the assignment by checking the configuration.
• Demonstrate the CUDA setup by running simple and sample programs.

UNIT III GPU AND ACCELERATOR PROGRAMMING: OpenCL
The OpenCL architecture - The platform model - The execution model - The programming model - The memory model - Shared virtual memory - Atomics and synchronization - Events and profiling OpenCL programs - OpenCL and other parallel software platforms

Suggested Activities:
• Flipped class on basics OpenCL.
• Practical – Execute sample OpenCL programs with different memory options

Suggested Evaluation Methods:
• Assignment on GPU programming using OpenCL
• Demonstrate the OpenCL setup by running sample programs.

UNIT IV GPU PROGRAMMING: PyCUDA
GPU programming using PyCUDA: kernals, threads, blocks, and grids – thread synchronization and intercommunication – Parallel prefix algorithm – Streams, events, contexts, and concurrency.

Suggested Activities:
• Flipped class on Python tool kit for CUDA.
• Practical – Write simple PyCUDA code with threads, blocks and grids

Suggested Evaluation Methods:
• Quiz on PyCUDA programming.
• Demonstrate the PyCUDA setup and execution of sample programs.

UNIT V ALGORITHMS ON GPU
Parallel Patterns: Parallel convolution: a basic algorithm, Constant memory and caching, Tiled convolution using caches for halo cells - Prefix scan: Parallel scan with the Brent-Kung algorithm, Segmented parallel scan for arbitrary-length inputs - Sparse Matrix computation: A simple SpMV
kernel with the COO format - Grouping row nonzeros with the CSR format - Improving memory coalescing with the ELL format.

**Suggested Activities:**
- Flipped class on Parallel patterns.
- Discussion on different parallel programming applications.

**Suggested Evaluation Methods:**
- Assignment on parallel programming algorithms.
- Demonstration of sparse matrix computation.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On completion of the course, the student will be able to:
1. Understand the need for parallel programming
2. Describe the GPU Architecture
3. Program GPU using CUDA and PyCUDA
4. Program GPU using OpenCL
5. Compare the CUDA and OpenCL programming
6. Identify efficient parallel programming patterns to solve problems

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UNIT I  INTRODUCTION  9

Suggested Activities:
- Solving simple Graph problems.
- Flipped classroom on isomorphism.
- External learning - Traveling salesman problem.
- Practical -
  - Implement a program to determine isomorphic graphs.
  - Implement a program to determine Hamiltonian circuits and Hamiltonian paths in a graph.

Suggested Evaluation Methods:
- Tutorials on graph algorithms.
- Assignment problems on isomorphism, hamiltonian graphs.
- Quizzes on connected components.

UNIT II  TREES AND CONNECTIVITY  9

Suggested Activities:
- Solving problems on tree properties and cut sets.
- Flipped classroom on spanning trees and fundamental circuits.
- External learning – Network flows.
- Practical -
  - Find all spanning trees of a graph.
  - Find all cut-sets in a graph.

Suggested Evaluation Methods:
- Tutorials on spanning trees and cut sets.
- Assignment problems on fundamental circuits and cut sets.
- Quizzes on network flows.

UNIT III  PLANARITY, COLOURING AND COVERING  9
Combinational and Geometric Graphs – Planar Graphs – Kuratowski’s Two Graphs – Different Representation of a Planar Graph – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem.

Suggested Activities:
- Solving Problems on planar graphs, chromatic number.
- Flipped classroom on matching and covering.
- External learning - Self-dual graphs and digraphs.
- Practical -
  - Implement a program to determine if a given graph G is planar or nonplanar
  - Finding all maximal independent sets
- Applications in real life problems.
Suggested Evaluation Methods:
- Tutorials on planar graphs.
- Assignments on matching and covering.
- Quizzes on planar graphs, chromatic number.

UNIT IV
GRAPH THEORETIC ALGORITHMS

Suggested Activities:
- External learning - Cut-Vertices and Separability.
- Practical -
  - Implementation of graph algorithms.
  - Finding a set of fundamental circuits in a graph.
- Flipped classroom on isomorphism.
- Applications in real life problems.

Suggested Evaluation Methods:
- Tutorials on connected components.
- Assignment on Planarity testing.

UNIT V
MACHINE LEARNING WITH GRAPHS

Suggested Activities:
- Practical -
- Applications in real life problems.

Suggested Evaluation Methods:
- Quiz on traditional approaches to machine learning using graphs.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Demonstrate understanding of the fundamental theorems of graph theory.
2. Identify and differentiate the potential use of special graphs and describe the basic properties of each kind.
3. Design and develop programs involving basic graph algorithms.
4. Introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields.
5. Apply the abstract concepts of graph theory in modeling and solving non-trivial problems in different fields of study.

TEXTBOOKS:

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AZ5004 COMPUTATIONAL INTELLIGENCE L T P C 3 0 0 3

UNIT I INTRODUCTION
Background and history of evolutionary computation - Behavioral Motivations for Fuzzy Logic, Myths and Applications areas of Computational Intelligence. Adaption - Self organization and Evolution - Historical Views of Computational Intelligence - Adaption and Self organization for Computational Intelligence - Ability to Generalize - Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

Suggested Activities:
- Flipped classroom on Applications areas of Computational Intelligence.

Suggested Evaluation Methods:
- Quiz on Adaption and Self organization for Computational Intelligence.
- Assignment on Computational Intelligence and Soft Computing Vs Artificial Intelligence and Hard Computing.

UNIT II NEURAL NETWORK CONCEPTS AND PARADIGMS
Neural Network History - What Neural Networks are and Why they are useful - Neural Networks Components and Terminology - Neural Networks Topology - Neural Network Adaption - Comparing Neural Networks and Other information Processing Methods - Preprocessing and Post Processing.

Suggested Activities:
- Create and view custom neural networks using MatLab.
- Implementation of XOR with backpropagation algorithm

Suggested Evaluation Methods:
- Quiz on neural networks.
• Assignment on comparison of Neural Networks and Other Information Processing Methods.

UNIT III EVOLUTIONARY COMPUTATION THEORY AND CONCEPTS 9

Suggested Activities:
- Flipped classroom on Evolution strategies.
- Programming exercises on maximizing a function using Genetic algorithm.

Suggested Evaluation Methods:
- Quiz on Genetic algorithms.
- Assignment on Evolutionary programming.

UNIT IV SWARM INTELLIGENCE 9
Particle Swarm Optimization: Particle Swarm Optimization Algorithm - PSO System Parameters - Modifications to PSO - Cooperative PSO - Particle Swarm Optimization versus Evolutionary Computing and Cultural Evolution – Applications. Ant Colony Optimization.

Suggested Activities:
- Flipped classroom on Modifications to Ant Colony Optimization.
- Implementation of Particle Swarm Optimisation algorithm for solving a problem.

Suggested Evaluation Methods:
- Quiz on Particle Swarm Optimization Algorithm.

UNIT V FUZZY SYSTEMS 9

Suggested Activities:
- Flipped classroom on Fuzzy Controllers.
- Install MatLab Fuzzy Logic Toolbox and ANN toolbox to design and simulate systems.
- Implementation of fuzzy control/ inference system

Suggested Evaluation Methods:
- Quiz on Fuzzy sets and membership functions.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to
1. Provide a basic exposition to the goals and methods of Computational Intelligence.
2. Understand and implement basic neural networks for solving problems.
3. Study of the design of Evolutionary Computation Theory.
4. Apply genetic algorithms to optimization problems.
5. Improve problem solving skills using the acquired knowledge in the areas of swarm intelligence,
6. Apply fuzzy logic and build fuzzy systems to handle uncertainty and solve engineering problems.

**TEXT BOOKS:**

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**UNIT I INTRODUCTION OF REINFORCEMENT LEARNING**


**Suggested Activities:**
- Group discussions to share their understanding and insights into reinforcement learning concepts and brainstorm ideas
- Coding exercises to implement and experiment with algorithms using any programming language or a reinforcement-learning framework.

**Suggested Evaluation methods:**
- Quizzes to assess students' understanding of the key concepts namely reinforcement learning, tabular solution methods, policy evaluation, policy improvement, and finite Markov decision processes.
- Reports on case studies they have worked on, highlighting their analysis of the problem,
application of tabular solution methods, and their findings and conclusions.

UNIT II  DYNAMIC PROGRAMMING APPROXIMATION  

**Suggested Activities:**
- Provide problem-solving exercises that involve deterministic shortest path problems and discrete deterministic optimization.
- Design and implement algorithms for sequential dynamic programming approximation and Q-factor parametric approximation using programming languages or reinforcement learning libraries to develop and test their solutions.

**Suggested Evaluation methods:**
- Group discussions or project presentations highlighting their understanding and application of sequential dynamic programming.

UNIT III  INFINITE HORIZON OVERVIEW

**Suggested Activities:**
- Use simulation environments to observe the behavior and performance of different algorithms in infinite horizon reinforcement learning.

**Suggested Evaluation methods:**
- Assessments that require them to apply infinite horizon dynamic programming techniques to solve given problems, such as calculating the optimal value function for a discounted problem or finding the optimal policy for a stochastic shortest path problem

UNIT IV  AGGREGATION AND LEARNING IMPLEMENTATION
Aggregation - Aggregation with Representative States, Continuous Control Space Discretization, POMDP Aggregation, Aggregation with Representative Features, Hard Aggregation – Implementation Resources - Q Learning - Q Learning with Code - Deep Q Network (DQN) - Double DQN - Dueling DQN - Policy Based Reinforcement Learning - Actor-Arctic Models and A3C - Deterministic Policy Gradient and the DDPG

**Suggested Activities:**
- Literature review on recent advancements and research papers related to aggregation in reinforcement learning.

**Suggested Evaluation methods:**
- Group projects- by evaluating the ability to apply aggregation techniques effectively and critically assess their performance in real-world scenarios.
UNIT V  PRACTICAL AND OPERATIONAL APPROACHES


Suggested Activities:
- Invite guest speakers or industry professionals who have experience with RL projects to share their insights and real-world examples.
- Hands-on workshops to explore RL toolkits and frameworks, such as OpenAI Gym, TensorFlow, or PyTorch

Suggested Evaluation Methods:
- Reflective journals or write reflection papers throughout the RL project life cycle to critically reflect experiences, challenges faced, lessons learned, and potential improvements for future RL projects.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student will be able to:
1. To recall the fundamental concepts of reinforcement learning and describe the basic principles and algorithms used in tabular solution methods.
2. Apply dynamic programming approximation techniques to solve deterministic and stochastic dynamic programming problems.
3. Analyze infinite horizon problems in reinforcement learning.
4. To evaluate the effectiveness of aggregation techniques, including aggregation with representative states and features.
5. To design and implement reinforcement learning systems using Q-learning and DQN algorithms.
6. To develop and refine RL projects, considering real-world implementation and deployment challenges.

TEXT BOOKS

REFERENCES
1. Deep Reinforcement Learning Frontiers of Artificial Intelligence By Mohit Sewak · 2019
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UNIT I - INTRODUCTION

Suggested Activities:
- Understanding the basics of IR.
- Study of other retrieval models.
- Practical – Implementation of the retrieval model with Lemur Tool kit and test the performance of different retrieval algorithms.

Suggested Evaluation Methods:
- Quizzes on IR and other retrieval models.
- Assignments on retrieval models.

UNIT II - PREPROCESSING

Suggested Activities:
- Study of indexing techniques.
- Practical – Implementation of vector space model.
- Flipped classroom on query expansion with thesaurus.

Suggested Evaluation Methods:
- Case studies on tokenization, stop word removal and stemming.
- Tutorials on query operations and languages.
UNIT III METRICS 9

Suggested Activities:
- Practical – Implementation of evaluation metrics.
- Study and implementation of PageRank algorithm.
- Study of web page duplicate detection technique.

Suggested Evaluation Methods:
- Tutorials on web search and crawling.
- Quizzes on precision, recall and f-measure.
- Assignments on web search engines.

UNIT IV CATEGORIZATION AND CLUSTERING 9

Suggested Activities:
- Study of different classification techniques and its uses in different applications.
- Practical – Implementation of classification and clustering techniques with WEKA tool.
- Assignments on clustering algorithms.

Suggested Evaluation Methods:
- Quizzes on different categorization and clustering methods.
- Exercise on categorization and clustering algorithms for real time applications.

UNIT V EXTRACTION AND INTEGRATION 9

Suggested Activities:
- Study of types of collaborative filtering techniques.
- Flipped classroom on semantic web.

Suggested Evaluation Methods:
- Assignments on item based and user based collaborative filtering techniques.
- Quizzes on semantic web.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Build an Information Retrieval system using the available tools.
2. Apply indexing and query expansion techniques for efficient retrieval.
3. Apply performance metrics to validate any information retrieval system.
5. Design and analyze the Web content structures.
6. Design and implement recommender and information extraction system.

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UNIT I | PATTERN CLASSIFIER | 9

Suggested Activities:
- In-class activity - Problems based on Z transform Circular and linear convolution.
- Testing of frequency transformation and convolution problems using Matlab.

Suggested Evaluation Methods:
- Quizzes on pattern recognition applications like image classification.
- Programming assignments on various pattern classifier techniques.
UNIT II  CLUSTERING  9
Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering – Density Based Clustering.

Suggested Activities:
- Implement hierarchical Clustering using MatLab.
- Implement EM Algorithm Using GMM using MatLab.

Suggested Evaluation Methods:
- Quizzes on various clustering techniques.
- Programming assignments on generating clusters for an unlabelled dataset.

UNIT III  FEATURE EXTRACTION AND SELECTION  9
Entropy Minimization – Karhunen Loeve Transformation – Feature Selection Through Functions Approximation – Binary Feature Selection – K-NN.

Suggested Activities:
- Implementation of K-NN in MatLab.
- Implementation of decision tree in MatLab

Suggested Evaluation Methods:
- Quizzes on feature selection methods.
- Programming assignments on KL transformation.

UNIT IV  HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES  6

Suggested Activities:
- Implement HMM algorithm in MatLab.
- Implement SVM classifier in MatLab.

Suggested Evaluation Methods:
- Quizzes on working principle of HMM.
- Programming assignments on SVM.

UNIT V  RECENT ADVANCES  12
Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network For Pattern Recognition, Hebbnet, Perceptron, ADALINE, Back Propagation.

Suggested Activities:
- Develop a supervised model to train neural net that uses the AND/OR/XOR gate functions.
- Create and view custom neural networks using MatLab.

Suggested Evaluation Methods:
- Quizzes on basic fuzzy and neural logic.
- Programming assignments on fuzzy classification methods.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic pattern classifier algorithms.
2. Have knowledge about the working principle of unsupervised algorithms.
3. Have knowledge about functionality of classifiers.
4. Perceive the recent advancement in pattern recognition.
5. Apply SVM and HMM algorithms for real time applications.
6. Implement advanced methodologies over image processing applications.

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AZ5006 BIO-INFORMATICS

UNIT I INTRODUCTION
Overview of Bioinformatics Technologies – Structural Bioinformatics – Data Format and Processing – Secondary Resources and Applications – Role of Structural Bioinformatics – Biological Data Integration System

Suggested Activities
- Exploring about Biological Data Integration System
- Understanding different data formats.

Suggested Evaluation Methods
- Quizzes on need of bioinformatics for real world scenario.
- Practical – Programming assignments on methods used for integrating biological data.
UNIT II  BIOINFORMATICS TOOL BOX
Sequence Analysis – NGS – Graph Theory – Gene Ontology – Importing Data and Deploying.

Suggested Activities
- Analyzing biomedical data using data mining tool in MatLab

Suggested Evaluation Methods
- Quizzes on various bioinformatics tools and its usage.
- Programming assignments on methods to analyze bio data using any one data mining tool

UNIT III  BIOLOGICAL DATA ANALYSIS
Microarray Data Analysis – Mass Spectrometry Data Analysis – Statistical Classification of Biological Data.

Suggested Activities:
- Flipped classroom on statistical classification of biological data.

Suggested Evaluation Methods:
- Quizzes on various data analysis methods.
- Programming assignments on various classification methods

UNIT IV  IMAGE PROCESSING

Suggested Activities:
- Extract the key features for biological image in MatLab.
- Implementing Spatial Transformations for image in MatLab.

Suggested Evaluation Methods:
- Quizzes on transformations used in bio-images.
- Programming assignments on applying various image processing methods on a simple bio application

UNIT V  SYSTEMS BIOLOGY

Suggested Activities
- Implementing sensitivity analysis for biology data in MatLab.

Suggested Evaluation Methods
- Quizzes on system biology.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to
1. Develop models for Biological Data.
2. Implement image processing Techniques to Bioinformatics Data.
3. Implement Micro Array analysis over Genome Expression.
4. Understand the study of simbiology.
5. Understand the pharmacokinetic modeling.
6. Understand the working model of biological data in Matlab.

TEXT BOOKS
1. Yi-Ping Phoebe Chen(Ed), "Bioinformatics Technologies", Springer Publications, 2005

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AZ5007 FULL STACK DATA SCIENCE L T P C 3 0 0 3

UNIT I DATA SCIENCE ESSENTIALS 9
Data Types-Operators-Variables--Control Flow Statements-Functions-User Defined Functions-Lambda Function; Data Structures-List-Tuples-Set-Dictionary; String Handling-Exception Handling.
Suggested Activities:
- Flipped classroom on python essentials for data science.
- Practical - Programming exercises involving the python basics and data structures.
Suggested Evaluation Methods:
- Quiz on core python concepts
- Assignments on python data structures.

UNIT II FULL STACK FOR APPLICATION DEVELOPMENT 9
Introduction to PyQt6-Installation-UI Widgets-Layout Management-Dialogs-Events-Example Applications-Packaging PyQt6 Applications for Windows-Deployment of PyQt6 Software in
Introduction to SQLite. Working with SQLite Database with PyQt6.

**Suggested Activities:**
- Flipped classroom on windows graphical user interface application.
- Practical – Develop GUI applications using various PyQt6 widgets.

**Suggested Evaluation Methods:**
- Practical – Working with SQLite Database using PyQt6
- Programming Assignments on PyQt6, SQLite database.
- Practical – Deploy PyQt6 Application in Windows / Linux.

**UNIT III  FULL STACK FOR WEB DEVELOPMENT  9**

**Suggested Activities:**
- Flipped classroom on HTML, Web Development using Flask Python.
- Practical – Develop web application using HTML form with Flask

**Suggested Evaluation Methods:**
- Quiz on Flask Python and Mongo DB
- Programming Assignments on Flask Python.
- Practical – Develop CRUD based Web Application using Flask with Mongo DB.

**UNIT IV  MACHINE LEARNING CONCEPTS  9**

**Suggested Activities:**
- Flipped classroom on Data Science for Data Processing and Machine Learning.
- Build Data Science Applications using Data Processing, Machine Learning using python APIs

**Suggested Evaluation Methods:**
- Quiz on Basics of Data Science, Machine Learning
- Assignments on Data Processing and Modelling, Machine Learning
- Practical – Develop full stack application for data science techniques such as data processing and machine learning.

**UNIT V  DATA SCIENCE FOR NLP, DATA MINING, DATA VISUALIZATION  9**
Natural Language Processing-Working with NLTK-SpaCy-Gensim-Examples. Data Mining and Data Scrapping- Working with Scrapy-BeautifulSoup; Data Visualization- Top Libraries-Working with Matplot-Seaborn-Plotly-Example Applications.

**Suggested Activities:**
- Flipped classroom on Data Science for NLP, Data Mining and Data Visualization.
- Practical – Build Data Science Applications using NLP, Data Mining and Data Visualization using Python APIs.

**Suggested Evaluation Methods:**
- Quiz and Assignments on NLP, Data Mining and Data Visualization
- Practical – Develop full stack application for data science techniques such as NLP, Data Mining and Data Visualization.

**TOTAL:45 PERIODS**
OUTCOMES:
On completion of the course, the students will be able to
1. Understand the essential concepts of python for data science
2. Develop and Package Desktop GUI applications using PyQt6 python.
3. Learn and Develop Web Applications with Database using Flask
4. To practice the data science techniques using data processing and modeling, machine learning
5. To practice the data science techniques using data visualization, data mining and natural language processing.

TEXT BOOKS:

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UNIT I  INTRODUCTION TO APPLIED CRYPTOGRAPHY  9

Suggested Activities:
- Implement Classical cryptographic algorithms using any Cryptographic tool.
- Practice cryptanalysis of classical cryptography and break them.
- Practice exponentiation and multiplicative inverses in modular arithmetic

Suggested Evaluation Methods:
- Quiz and assignments on classical cryptography
- Assignments on cryptanalysis of classical cryptography

UNIT II  CRYPTOGRAPHIC SYSTEMS  9

Suggested Activities:
- Demonstrate the working of DES, AES and ECC algorithms using CrypTool.
- Simulate and demonstrate various cryptographic attacks on DES, AES and ECC.

Suggested Evaluation Methods:
- Assignments on key generation and key expansions of DES, AES, ECC.
- Quiz on the mathematics behind the public key algorithms

UNIT III  HASH FUNCTIONS AND DIGITAL SIGNATURES  9

Suggested Activities:
- Use open source or free tools to calculate hash values using SHA 512
- Simulate the working of Digital signature schemes.

Suggested Evaluation Methods:
- Assignments on Digital Signature Standard
- Quiz on MAC and Hash functions
UNIT IV  KEY AGREEMENT AND DISTRIBUTION
Identification Scheme and Entity Attenuation-Challenge and Response in the Secret-key setting-Challenge and Response in the Public key Setting - Schnorr Identification Scheme - Key Pre-distribution - Unconditionally Secure key Pre-distribution - Key Agreement Scheme - Diffie-Hellman Key agreement - Public key infrastructure-PKI - Certificates - Zero Knowledge Proofs and Protocols

Suggested Activities:
- Debate on the challenges faced by secret key and public key crypto systems
- Simulate key agreement scheme using any open source tool

Suggested Evaluation Methods:
- Group presentation on the challenges faced
- Quiz on key distribution and key agreement

UNIT V  SECURITY APPLICATIONS

Suggested Activities:
- Debate on database and cloud security
- Deploy firewall in a system and analyze it's characteristics

Suggested Evaluation Methods
- Quiz on web security, transport layer security and network security applications

OUTCOMES:
On completion of the course, the students will be able to

1. Apply the basic security algorithms and policies required for a computing system.
2. Develop skills to use both symmetric and asymmetric key cryptography to ensure confidentiality.
3. Utilize specific hash functions and Mac algorithms for security applications.
4. Evaluate the application of different digital signature schemes in solving real world problems.
5. Critically analyze the challenges in symmetric and asymmetric key distribution.

TEXT BOOKS:

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AZ5009 AI IN SUPPLY CHAIN L T P C 3 0 0 3

UNIT I SUPPLY CHAIN FUNDAMENTALS 9
Supply Chain – Fundamentals, Evolution, Role in Economy, Importance, Decision Phases, Enablers & Drivers of supply chain Performance; Supply chain strategy; Supply Chain Performance Measures.

Suggested Activities
- Flipped classroom on supply chain performance
- Discussion on the need of supply chain

Suggested Evaluation Methods
- Assignment on Digital transformation in Supply chain

UNIT II SUPPLY CHAIN NETWORK 9
Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distribution network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network design, Impact of uncertainty on Network Design.

Suggested Activities
- Tutorial on network design and location intelligence.
- External learning on framework for Network design decisions in supply chain

Suggested Evaluation Methods
- Assignment on various software for network design

UNIT III PLANNING DEMAND, INVENTORY AND SUPPLY 9
Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain ,Analyzing impact of supply chain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item - multiple location inventory management; Pricing and Revenue Management
Suggested Activities
- Discussion on choosing the right ERP software.

Suggested Evaluation Methods
- Quiz on Inventory management system.

UNIT IV APPLICATION OF AI IN SUPPLY CHAIN MANAGEMENT

Suggested Activities
- Demonstrate Predictive customer behavior using Python.
- Demonstration of Demand and Sales Estimation using Python
- Read a latest survey in AI for supply chain management

Suggested Evaluation Methods
- Programming assignment applications of AI in Transportation and Distribution.
- Assignment on Sustainable development.

UNIT V CASE STUDIES
Case studies on Supply chain: Inventory management - Automation and Digitization – Real-time visibility & predictive analytics – Supply chain connectivity – Last-mile logistics- Identifying Vulnerabilities in the Machine Learning Model Supply Chain

Suggested Activities
- Exploring the dataset for AI in supply chain

Suggested Evaluation Methods
- Mini project with benchmark dataset

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to (5-6 outcomes)
1. Understand the need of supply chain management
2. Design a supply chain network
3. Plan based on inventory and supply
4. Use AI to solve supply chain problems
5. Write python programs with benchmark datasets and evaluation metrics.

TEXT BOOKS

REFERENCES
1. Atour Taghipour, “Demand Forecasting and order planning in supply chains and


4. Research Papers on AI for supply chain.

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AZ5010 PREDICTIVE ANALYTICS L T P C 3 0 0 3

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9
Overview of Predictive Analytics - The CRISP-DM Process Model for Predictive Analysis - The role of data in Predictive Analysis - Data Understanding - Data Visualization - The Value of Statistical Significance - Statistical concepts and tools for Predictive Analysis.

Suggested Activities:
- Case studies on applications for predictive analytics.
- Understanding of Challenges and issues of predictive analytics.
- Implementation of statistical concepts using tools.

Suggested Evaluation Methods:
- Assignment on applications of predictive analytics.
- Group presentation on statistical tools for analysis.
- Quiz on predictive analytics terminologies, tools and applications.

UNIT II DATA PREPARATION AND FEATURE SELECTION 9
Understanding the importance of data quality for Predictive Analysis - Data Preparation - Data preprocessing - Dealing with missing data and outliers - Feature selection/creation techniques - Exploratory data analysis for predictive modelling.

Suggested Activities:
- Solving problems related to Exploratory Data Analysis.
- Demonstration of tools for Data Pre-processing.
- Implementation of Feature selection algorithms.
UNIT III  PREDICTIVE MODELING TECHNIQUES

Suggested Activities:
- Case studies on Predictive modeling techniques.
- Practicing problems for decision tree, neural network, KNN, NB.
- Practicing problems for linear regression, multi-linear regression, etc.

Suggested Evaluation Methods:
- Assignment on Model Evaluation and Metrics for each technique.
- Demonstration on various techniques implemented with dataset.
- Quiz on predictive modeling techniques.

UNIT IV  TIME SERIES ANALYSIS AND FORECASTING
Introduction to Time Series Analysis and Forecasting - Components of time series - Trend and Seasonality analysis – ARIMA, LSTM modeling and forecasting - Exponential smoothing techniques – Model Evaluation - Applications.

Suggested Activities:
- Case studies on applications of Time series data analysis.
- Implement the ARIMA model.
- Develop a LSTM forecasting model for an application.

Suggested Evaluation Methods:
- Assignment on Trend and Seasonality analysis.
- Group presentation on real-time applications.
- Quiz on Model Evaluation and Performance.

UNIT V  ADVANCED TOPICS IN PREDICTIVE ANALYSIS
Deep Learning and its applications in Predictive Analysis - Unsupervised Learning techniques - Clustering and Association Rule Mining - Ensemble Learning and Model Stacking techniques - Ethical and legal considerations in Predictive Analysis – Case studies.

Suggested Activities:
- Case studies on deep learning applications for predictive analytics.
- Demonstrate Clustering model using tool.
- Implement Association rule mining using any analytical software.

Suggested Evaluation Methods:
- Assignment on Ensemble learning and model stacking.
• Demonstration of deep learning models for predictive analytics.
• Quiz on tools and applications.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to
1. Grasp the fundamental concepts of predictive analytics and its applications.
2. Understand the pre-processing of the data and importance of feature selection.
3. Perform exploratory data analysis to gain insights into data patterns.
4. Get hands-on practice with various predictive modeling techniques.
5. Acquire skills in model evaluation, model selection and model validation.
6. Apply predictive analytics to real-world problems using analytics software.

TEXT BOOKS

REFERENCES
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013.

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UNIT I 
BASICS OF IMAGE
Image representation and image analysis tasks - Image representations – digitization – properties – color images – Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Canny edge detection - Line detection by local pre-processing operators

Suggested Activities:
- Discussion on digital image and color models.
- Study of OpenCV libraries for image/video processing.
- Demonstration of offline/online tools for basic processing applications.

Suggested Evaluation Methods:
- Quizzes on different concepts for line and edge detection.
- Practical – Python programming assignments on image/video processing.

UNIT II 
FUNDAMENTALS OF VIDEO

Suggested Activities:
- Discussion on challenges in video processing and analytics.
- Study of standard video formats and applications.

Suggested Evaluation Methods:
- Quizzes on different motion estimation and tracking methods.
- Practical – Programming assignments on optical flow feature extraction.

UNIT III 
OBJECT DETECTION USING MACHINE LEARNING

Suggested Activities:
- Group discussion on the latest YOLO architecture and other techniques for object detection.
- Demonstration of offline/online tools for deep learning techniques in video analysis.

Suggested Evaluation Methods:
- Assignment on real-time object detection techniques.
- Practical – Programming assignments on YOLO techniques.

UNIT IV 
FACE RECOGNITION AND GESTURE RECOGNITION
Suggested Activities:
- Discussion on different features and dimensionality reduction techniques in image/video processing.
- Study of state of art face and gesture recognition techniques.

Suggested Evaluation Methods:
- Quizzes on different techniques used for face recognition in real-time.
- Practical – Programming assignments on feature extraction and object detection.

UNIT V VIDEO ANALYTICS USING DIFFERENT CNN
Video Processing – use cases of video analytics - Vanishing Gradient and exploding gradient problem - RestNet architecture - RestNet and skip connections - Inception Network - GoogleNet architecture - Improvement in Inception v2 - Video analytics: RestNet and Inception v3 / v4.

Suggested Activities:
- Discussion on different video surveillance techniques.
- Case study of RestNet and related techniques used in video analytics.

Suggested Evaluation Methods:
- Quizzes on real-time applications of video processing and analytics.
- Practical – Programming assignments on RestNet/GoogleNet.

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the basics of image and video processing techniques
2. Explain the techniques used for image pre-processing.
3. Develop various object detection techniques.
4. Understand the various face recognition mechanisms.
5. Elaborate on deep learning-based video analytics.

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TOTAL : 45 PERIODS
UNIT I  INTRODUCTION  9

Suggested Activities:
- Flipped classroom on different MR systems.
- Demonstration of the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:
- Tutorials on MR applications.
- Brainstorming session – VR effects.
- Quizzes on difference between VR and multimedia applications.

UNIT II  MR COMPUTING ARCHITECTURE  9

Suggested Activities:
- Flipped classroom on rendering requirements.
- External learning – Different types of graphics architectures and workstations.
- Demonstration of GPU programming.

Suggested Evaluation Methods:
- Tutorials on graphics pipeline.
- Brainstorming session – Graphics architectures.
- Practical - GPU programs for AR/VR Applications.

UNIT III  MR MODELING  9
Suggested Activities:
- Flipped classroom on modelling and rendering of 3D objects.
- External learning – Collision detection algorithms.
- Practical – Programs for 3D models.

Suggested Evaluation Methods:
- Tutorials on 3D modelling techniques.
- Group discussion on model management.
- Demonstration of three dimensional models.

UNIT IV  MR PROGRAMMING  
9

Suggested Activities:
- Case study – Different types of programming toolkits.
- Practical – Create VR scenes using toolkits like World ToolKit, Java 3D, Ghost, PeopleShop, Unity.

Suggested Evaluation Methods:
- Tutorial on programming toolkits for MR.
- Practical - Programming for scene creation in MR.

UNIT V  APPLICATIONS  
9

Suggested Activities:
- External learning – Different types of MR applications.
- Practical – Development of MR applications in medicine, entertainment, etc.
- Tutorials on MR applications

Suggested Evaluation Methods:
- A mini project on MR applications.
- Demonstration of MR application development and evaluation.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the basic concepts of mixed reality.
2. Design and develop the mixed reality applications in different domains.
3. Design various models for MR systems.
4. Implement mixed reality programming with toolkits.
5. Understand the working principles of MR.
6. Develop new mixed reality applications.

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AZ5012 APPLIED AI L T P C 3 0 0 3

UNIT I INTRODUCTION TO APPLIED AI 9
Basics of Artificial Intelligence – Turing Test - Applied Neural Networks – AI categories – Narrow, strong, super - AI Techniques - AGI, Deep learning, Reinforcement learning - Transfer learning

Suggested Activities:
- Transfer learning simple implementation
- Quiz on AI categories

Evaluation methods:
- Assignment on AI techniques

UNIT II IMAGE RECOGNITION WITH DEEP LEARNING AND NEURAL NETWORKS 9
Object recognition - Object detection – Face recognition - Image Classification - Neural Networks and Deep Learning for Image Classification - Image segmentation – Applications of Image Segmentation and Object Recognition

Suggested Activities:
- Discussion on Applications of Object detection and analysis
- Flipped class room on Deep learning models for image classification

Evaluation methods:
- Assignment / implementation of image recognition techniques

UNIT III APPLIED AI IN NATURAL LANGUAGE PROCESSING 9
Applied Machine Learning for Natural Language Processing – Text Classification -Sentiment

**Suggested Activities:**
- Discussion on Speech Emotion recognition
- Flipped Classroom activity on NLP

**Evaluation methods:**
- Quiz on Information retrieval techniques

**UNIT IV  AUTONOMOUS DRIVING AND GAN**

Introduction to Driverless Vehicles - Autonomous driving – Algorithms, approaches, and obstacles – Knowledge Graph - Generative Adversarial Network – Generator, Discriminator – Applications of GAN

**Suggested Activities:**
- Flipped class room on Autonomous lane detection techniques

**Evaluation methods:**
- Assignment on applications of GAN
- Assignment on future of autonomous driving

**UNIT V  AI IN SMART SYSTEMS AND ITS IMPACT**

Applied Artificial Intelligence in Smart Systems: AI- powered Assistants, Fraud prevention, Smart Homes - Future of AI - AI and Social impact: AI and Ethics, AI in Society, Singularity – Bias in AI

**Suggested Activities:**
- Tutorials on AI in Cyber Security

**Evaluation methods:**
- Assignment on AI-powered assistants
- Quiz on Impact of AI

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the students will be able to

1. Understand the influence of AI in different domains
2. Identify the selection of image and neural algorithms for various image recognition tasks
3. Design and implement NLP based text and speech systems
4. Design and implement Autonomous driving Algorithms for various real time applications
5. Identify the scope of AI in smart systems

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AZ5013 SOCIAL NETWORKS

UNIT I INTRODUCTION TO SOCIAL NETWORKS

Complex Networks, Overview of Social Network Analysis, Social Media Content, Levels of Network Analysis, Network Statistics, Representation of the Networks, Network Models, Network Centrality, Security and Privacy in Social Networks.

Suggested Activities:
- Practical – Study of existing social networks
- External learning – Problems on calculation of ties, density, path, length, distance, betweenness, centrality, clique.

Suggested Evaluation Methods:
- Demonstration of social network creation and calculating the related metrics.
- Assignments on calculation of ties, density, path, length, distance, betweenness, centrality, clique.
- Group discussion on data privacy and security social networks

UNIT II LINK PREDICTION

Link Analysis. Link Prediction, Link Prediction Methods, Metrics for Link prediction, prediction of Performance Metrics, Community Detection, Taxonomy of community criteria, Community evaluation, Ego Networks - Characteristics of Ego Networks, Ego Network Measures, Network Cohesion.

Suggested Activities:
- Practical – Discovering communities in social networks and techniques.
- External learning – Hands-on problems related to evaluating community metrics

Suggested Evaluation Methods:
- Demonstration – Link prediction and community identification
- Assignments on community detection approaches.

UNIT III INFORMATION DIFFUSION

Game Theoretic models, User behavior in social networks, Strategic Interaction in networks,

Suggested Activities:
- Practical – Analyzing user behavior in social networks.
- External learning – Exploring the use of different social network analysis tools

Suggested Evaluation Methods:
- Demonstration – Opinion analysis on social networks
- Assignments on Information diffusion in graphs.

UNIT IV SOCIAL SEMANTIC AND RECOMMENDER SYSTEM

Suggested Activities:
- Practical – Use of the features available in various ontology tools like Protégé.
- Flipped classroom on basic concepts of semantic web and ontology.
- External learning – Knowledge on semantic technology.

Suggested Evaluation Methods:
- Demonstration of created ontology.
- Tutorials on semantic web related terminologies.
- Quizzes on semantic technology for SNA.

UNIT V VISUALIZING, MINING SOCIAL NETWORKS
Taxonomy of Visualizations - Structural Visualization, Semantic and Temporal Visualization, Statistical Visualization, The Convergence of Visualization, Interaction and Analytics - Structural and Semantic Filtering with Ontologies, Centrality-based Visual Discovery and exploration, Mining Social Network Graphs - Clustering, Discovery of Communities, Partitioning, overlapping Communities, Simrank, Triangles in social networks, Neighborhoods, Transitive closure.

Suggested Activities:
- Practical – Exploring social networks and implementing innovative social network visualizations using tools such as Gephi, Cytoscape.
- Exploring applications in social networks.
- External learning – Investigating the role of visualization in real-world applications.

Suggested Evaluation Methods:
- Demonstration of immersive social network visualizations.
- Tutorials on innovative applications of social networks.
- Quizzes on state-of-the-art visualization techniques for social networks.
OUTCOMES:
On completion of the course, the students will be able to:
1. Grasp the fundamental principles of networks and social network analysis
2. Discover different community and analyzing information diffusion in social networks
3. Employ data mining and techniques for social network analysis.
4. Utilize advanced extraction and mining tools for social network analysis.
5. Develop personalized and immersive visualizations for social networks.
6. Design secure and ethical AI-powered social network applications.

TEXT BOOKS:
1. Social Network Modelling and Analysis, Niyati Aggrawal, Adarsh Anand, Taylor and Francis, 2022
2. Social Networks and the Semantic Web, Peter Mika, Springer 2007

REFERENCES:
1. Networks, Crowds, and Markets reasoning about a highly connected world
2. David Easley and Jon Kleinberg, Cambridge University Press, 2010
5. Analyzing Social Networks, Stephan P Borgatti, Martin G Everett, Jeffrey C Johnson, Sage Publications, 2017

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UNIT I  INTRODUCTION TO BLOCKCHAIN


Suggested Activities:
- External learning - Programming to create your own Blockchain.
- Flipped classroom on studying Blockchain security issues.

Suggested Evaluation Methods:
- Practical assessment to be conducted to evaluate the program for creating Blockchain.

UNIT II  INTRODUCTION TO CRYPTOCURRENCY


Suggested Activities:
- External learning - Creating the Wallets.
- Flipped classroom on showing the tracking process of transactions in Cryptocurrency.

Suggested Evaluation Methods:
- Assignment to be given on cryptocurrency failures.

UNIT III  ETHEREUM


Suggested Activities:
- External learning - Exploring Ethereum tools like Ganache and GO.
- Practical - Setup the Ethereum development environment.
- Practical - Develop smart contract on private Blockchain.

Suggested Evaluation Methods:
- Evaluation of developed smart contract on private Blockchain

UNIT IV  WEB3 AND HYPERLEDGER


Suggested Activities:
- Practical - Creating and deploying a business network on Hyperledger Composer Playground.
- Practical - Implementation of business network in Blockchain using hyperledger Fabric.
Suggested Evaluation Methods:
- Evaluation of developed business network on hyperledger fabric.

UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS 9

Suggested Activities:
- External learning - Blockchain using multichain.
- Assignments on Blockchain frameworks and business applications.

Suggested Evaluation Methods:
- Practical assessment of developing Blockchain based solution using Multichain for banking system.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the technology components of Blockchain and how it works behind the scenes.
2. Identify different approaches to developing decentralized applications.
3. Understand Bitcoin and its limitations by comparing with other alternative coins.
4. Devise solution using the Ethereum model.
5. Understand and use Hyperledger and its development framework.
6. Track alternative Blockchains and emerging trends in Blockchain.

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UNIT I   INTRODUCTION OF CLOUD SECURITY   9
Suggested Activities
• Exploration on different recent cloud technologies
• Understanding cloud security at enterprise level
Suggested Evaluation Methods
• Assignments on distinction between security and privacy
• Practice on virtualization mechanism

UNIT II   INFRASTRUCTURE SECURITY   9
Suggested Activities
• External learning – Data security schemes in cloud
• Implement IAM application
Suggested Evaluation Methods
• Assignments on Cloud authorization.

Unit III   SECURITY MANAGEMENT IN THE CLOUD   9
Suggested Activities
• Exploration on the various vulnerability tools
• Implementation of intrusion detection in real time scenarios.
Suggested Evaluation Methods
• Assignments on the design of access structure
• Tutorials on vulnerability tools

UNIT IV   PRIVACY   9
Key Privacy concerns in cloud-Data Life cycle-Changes to Risk and compliance to cloud- Legal and Regulatory Implications-International laws and regulations- Key management- Audit and compliance- Incremental CSP-COBIT-HIPAA - Cloud Security Alliance
Suggested Activities
• Implementation of a privacy application by adopting cloud data life cycle
• Analysis of privacy concerns in CSP
Suggested Evaluation Methods
• Assignment on key management infrastructure
• Assignment on risk and compliance to cloud.
UNIT V SECURITY AS A SERVICE


Suggested Activities
- External learning on SAS report and analysis
- Formulation of attack vectors of various

Suggested Evaluation Methods
- Assignments on security levels in a corporate scenario

Total Periods: 45

COURSE OUTCOMES:

Upon completion of the course, the students will be able to
1. Appreciate cloud resource management.
2. Articulate the main concepts, key technologies, strengths and limitations of Cloud Security
3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
4. Explain the core issues of cloud computing such as resource management and security.
5. Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud vulnerability tools

TEXT BOOKS:

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UNIT I  INTRODUCTION TO XAI  9
Introduction to Explainable AI: Motivation, Importance - Challenges and limitations of black box models - Types of Explainability – taxonomy of explanations - Interpretability – Importance of Interpretability - Taxonomy of Interpretability Methods - Scope of Interpretability - Evaluation of Interpretability - Properties of Explanations - Human-friendly Explanations

Suggested Activities
• Debate on Challenges and Limitations of Black-Box Models
• Group discussion about Interpretability of the models

Suggested Evaluation Methods
• Quiz on Properties of Explanations
• Assignment on Taxonomy of Explanations

UNIT II  INTERPRETABLE MACHINE LEARNING MODELS  9

Suggested Activities
• Choose a dataset and build a decision tree model, visualize and interpret decision tree’s structure
• Build a random forest model and explore feature importance
• Develop rule- based models for prediction
• Build a linear regression model using and explore feature importance

Suggested Evaluation Methods
• Tool based assignments on decision tree, random forest and regression using real world case studies.

UNIT III  MODEL AGNOSTIC XAI TECHNIQUES  9

Suggested Activities
• Apply Lime to a pre-trained model and generate local explanations
• Apply SHAP to a pre-trained model and generate explanations for individual predictions
• Visualize and interpret the relationships between features and predictions using PDP and ICE Plots

Suggested Evaluation Methods
• Programming assignments to demonstrate LIME and SHAP

UNIT IV  XAI FOR DEEP LEARNING  9
XAI for deep learning models - Gradient-based methods: Grad-CAM, Integrated gradients, Saliency Maps – Layer wise relevance propagation (LRP)– feature visualization- Deep Dream – Activation Maximization

Suggested Activities
• Build a deep learning model and analyze the importance of features in model’s predictions.
• Implement Grad cam visualization.
• Explore LRP techniques to assign relevance scores to individual input features.
• Explore existing XAI tools and frameworks that can be applied to deep learning models.

**Suggested Evaluation Methods**

• Group Presentation on Gradient based methods.
• Mini Project on Explainable Deep Learning

**UNIT V EVALUATION AND ETHICAL CONSIDERATIONS**

Evaluating XAI Methods - Metrics and criteria for evaluating explanation - Human-in-the-loop evaluation - User studies and feedback - Ethical Considerations in XAI - Bias, fairness, and transparency - Privacy and security concerns - Social and legal aspects of XAI – Applications

**Suggested Activities**

• Explore different evaluation metrics and criteria for evaluating explanation.
• Analyze the presence of bias and fairness issues in a chosen dataset.
• Debate on ethical dilemmas related to AI

**Suggested Evaluation Methods**

• Group discussion on Future Directions and Emerging Trends
• Practical Implementation of Interpretability in Deep Reinforcement Learning:
• Evaluate the mini project (given at the end of 4th unit) using different metrics.

**TOTAL: 45 PERIODS**

**OUTCOMES**

On completion of the course, the student will be able to:

1. Recall Taxonomy of explanations.
2. Understand interpretable machine learning principles of decision tree, rule based and linear models.
3. Apply Model Agnostic XAI techniques, interpret and explain predictions of machine learning models.
4. Develop XAI techniques for deep learning models.
5. Evaluate XAI methods and Propose innovative solutions to address ethical considerations
6. Apply XAI techniques in practical scenarios, for real-world datasets and problems.

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UNIT I  PROBABILISTIC AND MODEL-BASED LEARNING  9

Suggested Activities:
- Implement a simulation of a hidden Markov model using programming languages such as Python
- Hands-on experiment to demonstrate the concept of probability distribution.

Suggested Evaluation methods:
- Programming tasks or projects to implement probabilistic algorithms or models.
- Research paper or report exploring a specific topic related to probabilistic and model-based learning.

UNIT II  COMPUTATIONAL INTELLIGENCE IN BIOINFORMATICS  9
Introduction - Fuzzy Sets (FS) - Artificial Neural Networks (ANN) - Evolutionary Computing (EC) - Rough Sets (RS) – Hybridization - Application to Bioinformatics, Machine learning- Overfitting and under fitting - Types of machine learning, The math behind Deep learning- Tensors, mathematical operations, Clustering in Bioinformatics-Distance based Clustering in Bioinformatics, Graph based clustering in Bioinformatics, Biclustering , Multi-Objective Biclustering, Fuzzy Possibilistic Biclustering.

Suggested Activities:
- Creating Fuzzy inference system for bioinformatics data analysis.
- Explore biclustering methods for identifying co-expressed genes in microarray data.

Suggested Evaluation methods:
- Quizzes to assess the understanding of the mathematical concepts behind deep learning, tensors, and clustering algorithms.
- Assign a bioinformatics project/related case study that requires applying machine learning techniques.

UNIT III  DATA MINING FOR BIOINFORMATICS  9
Biological Databases and Integration- Introduction: Scientific Work Flows and Knowledge Discovery, Biological Data Storage and Analysis, Dimensionality, data cleaning and Integration- Feature selection and Extraction strategies in data mining-Filter and wrapper approaches- focus algorithm, relief method-Gram, Schmidt forward feature selection, Feature construction and extraction.

Suggested Activities:
- Learning how to handle missing data, outliers, and inconsistencies in biological datasets.
- Explore real-world bioinformatics problem and analyze the workflow of knowledge discovery.
Suggested Evaluation methods:

- Case studies involving real biological datasets are presented and following process to be carried out: analyze the data, perform feature selection, and provide insights.

UNIT IV DEEP LEARNING IN BIOINFORMATICS

Introduction to Deep Learning and bioinformatics- Convolutional Neural Networks (CNNs) for Bioinformatics-Convolutional neural network architecture: Convolution Layer, Pooling layer, Stride and padding-Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) Networks in Bioinformatics: Introduction-The problem, short-term memory-Protein sequence classification: Protein structure, Protein function, Prediction of protein function-LSTM with dropout-LSTM with bidirectional and CNN.

Suggested Activities:

- Coding exercises to implement and experiment with Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) in bioinformatics tasks.
- Industry experts or researchers working in the field of deep learning and bioinformatics to deliver guest lectures.

Suggested Evaluation methods:

- Quizzes and tests to assess the understanding of the concepts, architectures, and techniques related to CNNs and RNNs in bioinformatics.
- Practical exams - given a bioinformatics dataset and required to develop and train CNN and RNN models within a given timeframe.

UNIT V PROGRAMMING IN BIOINFORMATICS


Suggested Activities:

- Coding exercises to parse DNA data files and perform basic operations such as reading, writing, and extracting relevant information.

Suggested Evaluation methods:

- Quizzes or tests to assess theoretical knowledge related to the Python libraries

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to

1. Recall the fundamental concepts of probabilistic learning, computational issues related to probabilistic learning algorithms and propose solutions.
2. Apply frequentist statistical inference techniques to analyze data and make probabilistic predictions.
3. Implement computational intelligence methods for solving bioinformatics problems.
4. Analyze biological datasets using data mining techniques, evaluate the performance of machine learning models, and interpret the results.
5. Develop deep learning models for protein sequence classification and analysis.
6. Understand the functionalities of libraries such as Numpy, SciPy, and Akando in bioinformatics data processing and analysis.

TEXT BOOKS


REFERENCES
1. Python for Bio Informatics, Jason Kinser, Jones and Bartlett Publishers, 2009

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IT5043 ETHICAL HACKING L T P C 3 0 0 3

UNIT I INTRODUCTION TO HACKING

Suggested Activities:
- In-class activity to understand the penetration testing methodologies.
- Practical - Use security tools in Kali Linux to assess the vulnerabilities.
- Prepare Vulnerability Assessment summary reports.

Suggested Evaluation Methods:
- Assignment on categories of penetration testing and vulnerability summary reports.
- Quiz on penetration testing methodologies, OSSTMM and OWASP.

UNIT II INFORMATION GATHERING AND SCANNING
Suggested Activities:
- Explain different ways to gather the information of a system in the network.
- Demonstrate the network command tools to identify the system.
- Understand the network protocols and port scanning techniques using Kali linux.

Suggested Evaluation Methods:
- Assignment problems on information gathering and traceroute of ICMP, DNS and SNMP.
- Quizzes on enumeration, port scanning techniques and firewall/IDS evading techniques.

UNIT III NETWORK ATTACKS 9

Suggested Activities:
- Familiarizing with different types of attacks such as sniffing, spoofing etc.
- Demonstrating the MITM attack using ARP Poisoning using Kali Linux.
- Teaching with case studies: SSL Stripping, SQL Injection, Brute Force attacks.

Suggested Evaluation Methods:
- Assignment on denial of service (DoS) attack and hijacking session with MITM attack.
- Quizzes on SSL stripping, ARP spoofing and weak authentication.

UNIT IV EXPLOITATION 9

Suggested Activities:
- Case studies: Understand the Metasploit and Exploitations.
- Demonstrating email with malicious attachment and cracking the hashes.
- Practical - Implementing hashing algorithms and cracking the hashes.

Suggested Evaluation Methods:
- Assignments on social engineering toolkit and browser exploitation.
- Quizzes on reconnaissance with Metasploit and client–side exploitation methods.

UNIT V WIRELESS AND WEB HACKING 9

**Suggested Activities:**
- Cracking the WEP and WPA/WPA2 passphrase using Cracking tool in Kali Linux.
- Design a web application with different authentication mechanism.
- Understand the protection mechanism to prevent against various server attacks.

**Suggested Evaluation Methods:**
- Assignment on evil twin attack and denial of service attack on access point in WLAN.
- Quizzes on types of authentication and vulnerabilities in a web application.

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Use the various security tools to assess the computing system.
2. Predict the vulnerabilities across any computing system using penetration testing.
3. Identify prediction mechanism to prevent any kind of attacks.
4. Protect the system from malicious software and worms.
5. Evaluate the wireless network flaws and able to apply security patches.
6. Analyze the risk and support the organization for effective security measures.

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UNIT 1: INTRODUCTION TO MLOPs

Suggested Activities:
- Flipped classroom on MLOps.
- Learning – MLOps Tools, Types of ML Software.

Suggested Evaluation Methods
- Quiz on MLOps
- Tutorials on MLOps Essentials

UNIT 2: DATABASE FOR MLOPs
SQL vs NoSQL-Differences-Pros and cons; Working with MySQL Database using Python-CRUD-Examples-Introduction to MongoDB- MongoDB using Python-CRUD-Examples.

Suggested Activities:
- Flipped classroom on SQLite and MongoDB
- Practical - Working with SQLite CRUD Examples using Python
- Practical - Working with MongoDB CRUD Examples using Python

Suggested Evaluation Methods
- Quiz on SQLite, MongoDB
- Tutorials on Python Databases.
- Demonstration of Programs using SQLite and MongoDB.

UNIT 3: MACHINE LEARNING MODELS

Suggested Activities:
- Flipped classroom on Machine Learning Models
- Implementation of Supervised Machine Learning Algorithms using Python
- Implementation of Unsupervised Machine Learning Algorithms using Python

Suggested Evaluation Methods
- Quiz on Machine Learning Models

UNIT 4: TRACKING ML PROJECTS
MLflow – Tracking ML Experiments using MLflow.

**Suggested Activities:**
- Flipped classroom on Docker Container and MLflow
- Java Application Deployment using Docker on Windows / Linux
- Python Application Deployment using Docker on Windows / Linux
- Tracking ML projects using MLflow.

**Suggested Evaluation Methods**
- Quiz on Docker and MLflow
- Demonstration of Deployed Applications using Docker
- Tutorials on MLflow with Python.

**UNIT 5: MLOPs IN CLOUD**


**Suggested Activities:**
- Flipped classroom on Cloud Machine Learning
- Flipped classroom on deployment of ML models using cloud tools
- Practical – Deployment of ML Models into Cloud Azure / AWS / GCP

**Suggested Evaluation Methods**
- Quiz on Cloud Service Providers – Azure / AWS SageMaker / GCP
- Tutorials on Machine Learning Operations with Cloud
- Demonstration of Deployed ML Models using Cloud Tools.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:

1. Understand the essential concepts of MLOps
2. Develop Database Applications using SQLite and MongoDB with Python
3. Learn and Implement the Machine Learning Models
4. Deploy applications using Docker and Track ML projects using MLFlow
5. Deploy MLOps in Cloud Platforms – AWS / Azure / GCP.

**TEXTBOOKS:**


REFERENCES:
1. “ML Ops: Operationalizing Data Science” by David Sweenor, Steven Hillion, Dan Rope, Dev Kannabiran, Thomas Hill, Michael O’Connell.

MAPPING of CO’s with PO’s and PSO’s

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IT5018 QUANTUM COMPUTING L T P C 3 0 0 3

UNIT I FUNDAMENTAL CONCEPTS 9

Suggested Activities:
- Flipped classroom on quantum algorithms, information processing.
- Tutorials on applications of algorithms.

Suggested Evaluation Methods:
- Quiz on quantum bits.
- Problem solving assignment on quantum computation.
- Programming assignment on quantum algorithms.

UNIT II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS 9

Suggested Activities:
- Flipped classroom on postulates, computational models.
Computational analysis of common problems like Travelling Salesman.

**Suggested Evaluation Methods:**
1. Quiz on postulates and computational models.
2. Problem solving assignment on application of quantum mechanics.
3. Programming assignment on Turing machines.

**UNIT III QUANTUM COMPUTATION**
9

**Suggested Activities:**
- Flipped classroom on simulation, Fourier transform.
- Simulation Exercises.
- Tutorials on quantum search algorithms.

**Suggested Evaluation Methods:**
- Quiz on the quantum algorithm and quantum circuits.
- Problem solving assignment on text book exercise questions.
- Programming assignment on search algorithms.

**UNIT IV QUANTUM INFORMATION**
9

**Suggested Activities:**
- Flipped classroom on quantum operations.
- Tutorials on examples and application of quantum operations.

**Suggested Evaluation Methods:**
- Quiz on quantum operations.
- Problem solving assignment on applications of quantum operations.

**UNIT V QUANTUM MACHINE LEARNING**
9

**Suggested Activities:**
- Flipped classroom on quantum machine learning.
- Extra reading and discussion from reference books.

**Suggested Evaluation Methods:**
- Quiz on quantum machine learning.
- Problem solving assignment on text book exercise questions

**OUTCOMES**
On completion of the course, the students will be able to
1. Understand the basics of quantum computing.
2. Understand the background of Quantum Mechanics.
3. Analyse the computation models.
4. Model the circuits using quantum computation.
5. Understand the quantum operations such as noise and error–correction.
6. Appreciate the need of quantum machine learning.

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AZ5018 COGNITIVE MODELS FOR COMPUTING L T P C 3 0 0 3

UNIT 1: INTRODUCTION TO COGNITIVE MODELLING 9
Definition - Goals - Approaches – Benefits – Developing Cognitive Models – Theoretical Frameworks – Cognitive Architectures and Models – Role in understanding human cognition

Suggested Activities
- Divide the students into groups and instruct them to review literatures related to cognitive architectures
- Group Presentation on the review carried out.

Suggested Evaluation Method
- Quiz on Cognitive Architectures and Models
UNIT 2: COGNITIVE MODEL TYPES

Rule Based Models - Production Rules – Conditions – Actions - Build Rule based Model –
Connectionist Models – Basic Concepts - Building and validating a connectionist model - Hybrid
Model - ACT-R – SOAR – Production Systems and Cognitive Architectures – Building and validating
a hybrid model

Suggested Activities
- Choose a simple cognitive task and implement a rule based model to simulate this.
- Choose a simple cognitive task and construct a connectionist neural network model using
  TensorFlow or PyTorch.

Suggested Evaluation Methods
- Group discussion on the advantages and limitations of all three models

UNIT 3: MODELLING COGNITIVE PROCESSES – I

Perceptual organization - Attention – Perception – Models - Learning and Memory – Memory
systems and Models – Encoding, Storage, Retrieval Processes – Reinforcement learning – Working
Memory and Cognitive Control - Long Term Memory models

Suggested Activities
- Design an attention experiment and investigate the effects of different factors on attentional
  processes.
- Form groups and analyze different learning strategies.
- Choose a memory experiment and investigate factors such as encoding processes
  or interference effects.

Suggested Evaluation Methods
- Written assessments or quiz on modelling cognitive processes
- Develop research proposals addressing attention, perception, learning or memory

UNIT 4: MODELLING COGNITIVE PROCESSES – II

Language Processing – Communication - Decision Making & problem Solving –Cognitive
Processes in Decision making –Rational and Heuristic Decision Making Models - Decision making
under uncertainty - Dynamical and Complex Systems – Large Scale Modelling

Suggested Activities
- Explore various cognitive biases influencing decision making such as confirmation bias,
  availability heuristic etc.

Suggested Evaluation Methods
- Present a language experiment report after investigating word recognition and
  sentence parsing.

UNIT 5: APPLICATIONS OF COGNITIVE MODELLING

Cognitive Modelling in Engineering - Education – Human Computer interaction – User Experience
Design – Cognitive Workload and Humana factors Engineering - Systems Design and Evaluation -
Robotics - Linguistic applications of cognitive modelling – Future Trends
Suggested Activities
- Explore the intersection of cognitive modeling and artificial intelligence.

Suggested Evaluation Methods
- Case study Presentation

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to

1. Explore the fundamental concepts and principles of cognitive modeling and its role in understanding human cognition.
2. Explain the differences between symbolic and connectionist approaches in cognitive modeling.
3. Apply cognitive modeling techniques to analyze and simulate cognitive processes related to perception, attention, memory and long term memory.
4. Apply techniques to simulate and interpret cognitive processes related to decision-making, problem-solving in large scale systems.
5. Utilize cognitive modeling techniques to address and solve problems in various domains, such as language processing and decision-making

TEXT BOOKS:

REFERENCES:

MAPPING of Course Outcomes with Program Outcomes

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UNIT 1  INTRODUCTION  
Suggested Activities:  
- Flipped classroom on mobile applications and types of frameworks.  
- Theory – study about different types of mobile applications, frameworks, platforms and tools.  
Suggested Evaluation Methods  
- Quiz on types of mobile applications and frameworks.  
- Assignments on mobile frameworks, UI/UX design tools.  

UNIT 2  ANDROID APPLICATION DEVELOPMENT  
Suggested Activities:  
- Flipped classroom on android architecture and tools.  
- Practical – Develop Native Android Smartphone Applications using Java / Kotlin.  
- Practical – Develop Android Application for Intents.  
- Practical – Working with SQLite CRUD examples using Android Application.  
Suggested Evaluation Methods  
- Quiz on android app development, and components.  
- Program on SQLite Database with android.  
- Assignment on application components, types of intents.  

UNIT 3  IOS APPLICATION DEVELOPMENT  
Suggested Activities:  
- Flipped classroom on iOS app development and tools.  
- Practical – Develop native iOS smartphone application using Objective-C / Swift  
- Practical – Working with various UI Controls using iOS application.  
- Practical – Working with SQLite database using iOS application.  
Suggested Evaluation Methods  
- Quiz on iOS app development.  
- Assignment on iOS data persistence.  
- Program on iOS application for SQLite database.  

UNIT 4  AI IN MOBILE APPLICATION DEVELOPMENT  
AI technologies for mobile applications - A simple AI based Chatbot using Android / iOS; AI powered mobile apps – Architecture: Google Assistant, Siri, Replika, Cortona, Elsa – FaceApp, Amazon Alexa.
Suggested Activities:
- Flipped classroom on AI in mobile application development & key elements.
- Case study of AI powered mobile apps.
- Demonstration of Developed AI based chatbot using android / iOS.

Suggested Evaluation Methods
- Quiz on key concepts of AI in mobile application development.
- Practical – Build AI based chatbot using Android / iOS application.

UNIT 5 AI TOOLS FOR MOBILE APPLICATION DEVELOPMENT
Usage of AI in mobile apps; Build AI mobile apps – Implementation considerations; AI tools: CoreML- TensorFlow – ML Kit -OpenCV – Caffe2 – Emerging AI applications in smartphones.

Suggested Activities:
- Flipped classroom on AI application development and tools.
- Demonstration of popular existing mobile applications using AI tools.

Suggested Evaluation Methods
- Quiz and assignments on AI tools in mobile application development
- Practical – Develop Android / iOS mobile application using AI tools.

COURSE OUTCOMES:
At the end of the course the students will be able to
1. Understand the frameworks, platforms and tools of mobile application development.
2. Learn native Android application development using Java / kotlin.
3. Understand native iOS application development using Objective-C / Swift.
4. Learn implementation aspects of AI in mobile application development.
5. Develop AI based mobile application using Android / iOS.

TOTAL : 45 PERIODS

TEXTBOOKS:

REFERENCES:
3. Professional mobile Application Development paperback,2012 Jeff Mcherter (Author),Scott Gowell (Author), Wiley India Private Limited
5. https://www.tensorflow.org/lite/examples

MAPPING of CO’s with PO’s and PSO’s

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UNIT I
INTRODUCTION OF CONVERSATIONAL ANALYTICS
9
Studying Social Interaction from a CA Perspective- Intellectual Roots and Contexts for Conversation Analysis- The Conversation Analytic Approach to Data Collection- The Conversation Analytic Approach to Transcription- Basic Conversation Analytic Methods.

Suggested Activities
- Exploration on different parts of a conversation with examples
- External learning on conversational analytics techniques.

Suggested Evaluation Methods
- Assignments on Conversational analytic methods
- Tutorials on approaches on conversational analytics

UNIT II
FUNDAMENTAL STRUCTURES OF CONVERSATION
9
Action Formation and Ascription - Turn Design- Turn-Constructional Units and the Transition-Relevance Place-Turn Allocation and Turn Sharing-Sequence-Repair-Preference Organization-Overall Structural Organization

Suggested Activities
- External learning – Turn design and allocation in conversation
- Implement IAM application

Suggested Evaluation Methods
- Assignments on constructional units and transition

UNIT III
KEY TOPICS IN CA
9

Suggested Activities
- Exploration on conversational emotion and effect.
- Implementation of action in conversation

Suggested Evaluation Methods
- Assignments on the design of embodied action
- Tutorials on grammar.

UNIT IV
KEY CONTEXTS OF STUDY IN CA: POPULATIONS AND SETTINGS
9
Interaction among Children-Conversation Analysis and the Study of Atypical Populations- Conversation Analysis in Psychotherapy- Conversation Analysis in Medicine, Newsroom and Interview- Conversation Analysis and Linguistics
Suggested Activities
- Implementation of a conversational AI application by adopting cloud data life cycle
- Analysis of conversation in different scenarios

Suggested Evaluation Methods
- Assignment on conversational analytics in classroom

UNIT V CHATGPT
Introduction to CHATGPT and AI Chatbots- Strategy for asking prompts-Advanced techniques for prompts- Real world applications for asking prompts.

Suggested Activities
- External learning on CHATGPT design
- Formulation of prompts for any conversation in an application.

Suggested Evaluation Methods
- Assignments on AI chatbots

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
1. Develop a conversational structure.
2. Articulate the main concepts, key technologies, strengths and limitations of Conversational analytics
3. Develop the ability to understand and use the structure of conversation and delivery methods
4. Explain the formulation of prompts and deployment
5. Choose the appropriate technologies, algorithms and approaches for implementation of AI chatbots

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UNIT I - INTRODUCTION TO MULTIMEDIA ELEMENTS

Suggested Activities:
- Flipped classroom on multimedia concepts.
- Practical - Creating and editing visual elements using tools like Audacity, Fontographer, Blender, Photoshop and flash.

Suggested Evaluation Methods:
- Demonstration on creating visual elements using audio and video editing tools.
- Creativity and visual appearance.
- Quizzes on multimedia elements and their characteristics.

UNIT II - MULTIMEDIA COMPRESSION

Suggested Activities:
- Flipped classroom on different compression techniques.
- Practical - Adobe Premier Pro for digital video concepts.

Suggested Evaluation Methods:
- Demonstration on Adobe Packages.
- Assignment on compression techniques.
- Quizzes on video based visual effects.

UNIT III - MULTIMEDIA ARCHITECTURES

Suggested Activities:
- Flipped classroom on concepts of Multimedia hardware architectures.
- External learning - Digital Repositories.

Suggested Evaluation Methods:
- Tutorials on OCR/OMR
- Quizzes on various multimedia storage

UNIT IV - MULTIMEDIA OPERATING SYSTEM AND DATABASES
a database model.

**Suggested Activities:**
- Flipped classroom on Multimedia Database and indexing structures.
- External learning - Data structures for storing multimedia data.

**Suggested Evaluation Methods:**
- Tutorials on memory and process management algorithms.
- Quizzes on deadlocks and synchronization.

**UNIT V** — **MULTIMEDIA COMMUNICATION & APPLICATIONS**


**Suggested Activities:**
- Practical - Designing user interfaces and developing simple games.
- External learning - Mixed Reality.

**Suggested Evaluation Methods:**
- Demonstration of developed applications.
- Quizzes on virtual reality and augmented reality.

**OUTCOMES:**

On completion of the course, the students will be able to:
1. Handle the multimedia elements effectively.
2. Encode and decode the multimedia elements.
3. Understand the underlying multimedia computing architectures used for media development.
4. Develop effective strategies to deliver Quality-of-Experience in multimedia applications.
5. Design and implement algorithms and techniques related to multimedia objects.
6. Design and develop multimedia applications in various domains.

**TEXT BOOKS**


**REFERENCES:**


**MAPPING of CO's with PO's and PSO's**

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UNIT I OVERVIEW OF CYBERSECURITY

Suggested Activities
- External learning on the statistics of cyber attacks
- External learning on reconnaissance for cyber security

Suggested Evaluation Methods
- Assignment on NIST Cybersecurity framework

UNIT II MALWARE ANALYSIS

Suggested Activities
- Study on best practices for Malware analysis
- Demonstration of Malware detection

Suggested Evaluation Methods
- Group project on malware detection

UNIT III NETWORK PROTECTION

Suggested Activities
- Discussion papers on Deepfake recognition
- Demonstration of intrusion detection and anomaly detection.

Suggested Evaluation Methods
- Assignment on Penetration testing
UNIT IV       APPLICATION SECURITY
Phishing Webpage and Email detection - Introduction to detecting spam – Spam filters – Perceptron based spam filter – Spam detection with SVMs – Phishing detection using logistic regression and decision trees – Spam detection with Naïve Bayes.

Suggested Activities
- Video lectures on Spam detection
- Demonstration of email URL Phishing

Suggested Evaluation Methods
- Programming assignment on predicting Spam or Ham.

UNIT V       CASE STUDIES

Suggested Activities
- Tutorial on Adversarial machine learning
- Case studies

Suggested Evaluation Methods
- Assignment on security issues in AI

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to (5-6 outcomes)
1. Grasp the fundamentals of Cyber security
2. Knowledge of malware and countermeasures
3. Ability to detect Intrusion and Anomaly detection using AI algorithms
4. Able to realize Application security using AI
5. Gain knowledge of other roles of AI in Cyber security

TEXT BOOKS

REFERENCES
4. Research papers on AI for Cyber Security
UNIT I  GENOMIC AND PROTEOMIC DATA ANALYSIS  9
Introduction to Proteomics techniques - Data Mining, Data Pre-Processing, Dimensionality problem, Predictive Model construction, Post-Processing-Principles of Microarray Investigations, Pre-Planning stage, Statistical Design principles - Affymetrix GeneChips, Two-Color microarrays-and pre-processing data-Caveats and Pitfalls-Mass Spectrometry data and pre-Processing, Tools and Resources - Visualization in Genomics and Proteomics

Suggested Activities
- Using dataset of microarray gene expression data, perform pre-processing and analyze the impact on data.
- Design a microarray experiment to investigate the gene expression differences between two groups of samples.
- Create a visualization of gene expression or protein expression data, explore various visualization techniques and their effectiveness in representing data.

Suggested Evaluation Methods
- Evaluate the students' engagement and participation in group discussions and activities related to data pre-processing, microarray design, mass spectrometry data analysis, and visualization techniques.
- Assign a data analysis project that need to apply the techniques learnt to analyze a real-world dataset.

UNIT II  MACHINE LEARNING APPROACHES  9
Genomics and Proteomics data - Feature Selection, Dimensionality Reduction, Clustering in Genomic Data, Resampling for model selection and optimizing parameters-Methods, model selection Optimizing tuning parameters, Comparison of Resampling strategies, Classification of Genomic and Proteomic Data using support vector machines, Networks in cell Biology, Case studies.

Suggested Activities
- Use case studies to demonstrate the application of these technique in real-world scenarios.
- Create a protein network or metabolic network using graph definition.
Suggested Evaluation Methods

- Evaluate the effectiveness and performance of methods for a given genomic or proteomic dataset.
- Evaluate the quality of the protein network or metabolic network created using graph definition.

UNIT III DATA MINING AND ONTOLOGIES IN GENOMICS

Integrative Data Analysis and Visualization, Motivation and Approaches, Goals and challenges- Multiple data types-Text mining and NLP, Database and resources-Applications, NLP in Biomedicine, Text mining in Genomics, Biomedicine- Ontologies and Information Mining in Genome, Functional Analysis, Bio-Ontologies and the Gene Ontology in Functional Genomics.

Suggested Activities

- Case studies on integrative data analysis of biomedical data using various tools and techniques.
- Hands-on training on text mining and NLP tools to extract relevant information from biomedical databases.

Suggested Evaluation Methods

- Evaluating the accuracy and effectiveness of text mining and NLP tools in extracting biomedical information.
- Evaluating the understanding on the concepts, tools, and techniques covered through quizzes.

UNIT IV MODELS AND APPLICATIONS


Suggested Activities

- Group discussions and critique deep learning-based approaches in genomics and proteomics research.
- Develop and implement deep learning models for gene expression analysis using available tools and pipelines.
- Collaborate with biologists and bioinformaticians to design experiments and analyze genomic and proteomic data using deep learning tools and techniques.

Suggested Evaluation Methods

- Assign coding assignments that involve implementing deep learning models for sequence analysis, protein structure prediction, or other related tasks and evaluate it.
- Assign projects or case studies related to deep learning models in genomics and proteomics. Evaluate them based on their methodology, accuracy, and feasibility of the solution.

UNIT V ETHICS, PRIVACY AND SOCIAL IMPLICATIONS

Ethics in genomics and proteomics research, Privacy concerns and data sharing, Emerging ethical and policy issues in genomics and proteomics research, Ethical Issues in the Use of AI and Machine Learning in Genomics and Proteomics, Social Implications, Impact of genomic research on healthcare, Future directions and Challenges.

Suggested Activities

- Group discussions and debates on ethical and policy issues related to genomics and proteomics research, such as privacy concerns and data sharing.
• Case studies analyzing real-world ethical issues that have arisen in genomics and proteomics research, and the implications of those issues for the field as a whole.
• Guest lectures by experts in bioethics or related fields.

**Suggested Evaluation Methods**
• Presentations and case studies on the use of AI and machine learning in genomics and proteomics, highlighting ethical considerations and potential challenges.
• Quizzes that test understanding of key ethical concepts and principles in genomics and proteomics research.

**TOTAL: 45 PERIODS**

**OUTCOMES**
**On completion of the course, the students will be able to**
1. Apply the techniques and tools of genomics and proteomics data analysis and identify the principles.
3. Apply statistical methods to analyze microarray investigations and mass spectrometry data.
4. Utilize text mining and ontology-based analysis to explore biomedical data.
5. Apply deep learning models for sequence analysis and protein structure prediction in genomics and proteomics research and evaluate its effectiveness.
6. Identify the ethical and social implications of genomics and proteomics research and its impact on society.

**TEXT BOOKS**
2. Francisco Azuaje, Joaquin Dopazo “Data Analysis and Visualization in Genomics and Proteomics, Wiley
3. Faheem Masoodi, Mohammad Quasim, Syed Bukhari, Sarvottam Dixit, Shadab Alam “Applications of Machine Learning and Deep Learning on Biological Data”, CRC Press, 2023

**REFERENCES**
2. Soraj Hongladarom "Genomics and Bioethics: Interdisciplinary Perspectives, Technologies and Advancements", IGI Global

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UNIT I  INTRODUCTION 9
Introduction to AI - Descriptive Ethics - Normative Ethics - Meta-ethics – Applied ethics - Relationship Between Ethics and Law - Machine Ethics

Suggested Activities:
- Flipped classroom on introduction to AI.
- External learning – Learn about other type of ethics and their relation to AI.
- Group discussion on workplace ethics conflicts.

Suggested Evaluation Methods:
- Assignment on the relationship between ethics and law.
- Quiz on Machine ethics.

UNIT II  TRUST AND FAIRNESS IN AI 9

Suggested Activities:
- Case study on ethics in designing autonomous vehicle.
- Flipped classroom learning on mistargeting by an autonomous weapon.
- Reflect on how self-driving cars is going to continue to grow in the future.

Suggested Evaluation Methods:
- Assignment on ethical dilemmas self-driving cars pose to our society.
- Quiz on Responsibility and Liability.

UNIT III  RISKS IN AI 9

Suggested Activities:
- Present a business case for the importance of integrity and ethics in business.
- Case study on the risks of AI to workers and how it affects them.
- Flipped classroom learning on a privacy issue created by AI.

Suggested Evaluation Methods:
- Quiz on Privacy related issues in AI.
- Tutorial on ethical risks of AI.
UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS


Suggested Activities:
- Case study on how robots creates ethical issues in the society.
- Flipped classroom learning on Ethical Issues in an ICT Society.

Suggested Evaluation Methods:
- Assessment on ethics and morality and how it is affected by Robots.
- Quiz on Roboethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

Challenges – Opportunities- Ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

Suggested Activities:
- Case study on ethical decisions that affect individuals and companies.
- Flipped classroom learning on Artificial Intelligence in medicine and how it affects individuals.

Suggested Evaluation Methods:
- Assignment on National and International Strategies on AI.
- Quiz in Challenges and opportunities in artificial intelligence.

OUTCOMES:

On completion of the course, the students will be able to:
1. Understand and differentiate the different ethics in AI.
2. Identify the Responsibility and Liability in AI Systems.
3. Understand the ethical risks of AI and the risks of companies and workers in AI.
4. To understand the privacy issues of the data.
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI.

TEXT BOOKS:

REFERENCES:
2. Eleanor Bird, Jasmin Fox-Skelley, Nicola Jenner, Ruth Larbe, Emma Weitkamp and Alan Winfield, The ethics of artificial intelligence: Issues and initiatives, EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
4. S.Matthew Liao, Ethics of Artificial Intelligence, Oxford University Press, 2020
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HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C 3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- To familiarize students with the concept of communication using linguistic and non-linguistic resources.
- To help students ask critical questions regarding facts and opinions.
- To provide students with the material to discuss issues such as language and power structures.
- To help students think critically about false propaganda and fake news.

Learning Outcomes

- Students will be able to use linguistic and non-linguistic resources of language in an integrated manner for communication.
- Students will be able to analyse communication in terms of facts and opinions.
- Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriation
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II
STRUCTURE OF WRITING/CONVERSATION: 9
a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III
POWER STRUCTURE AND LANGUAGE USE: 9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV
MEDIA COMMUNICATION: 9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V
PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

HU5172
VALUES AND ETHICS
L T P C
3 0 0 3

OBJECTIVES:
- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.
UNIT I  DEFINITION AND CLASSIFICATION OF VALUES  9
Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-
Social-Aesthetic-Moral and Religious values

UNIT II  CONCEPTS RELATED TO VALUES  9
Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III  IDEOLOGY OF SARVODAYA  9
Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV  SUSTENANCE OF LIFE  9
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V  VIEWS ON HIERARCHY OF VALUES  9
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya
and Mahatma Gandhi

OUTCOMES:
CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

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TEXTBOOKS:
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)

HU5173  HUMAN RELATIONS AT WORK  L T P C  3 0 0 3

OBJECTIVES:
• Illustrate human relations at work its relationship with self.
• Explain the importance of interacting with people at work to develop teamwork.
• Infer the importance of physical health in maintaining human relations at work.
• Describe the importance of staying psychologically healthy.
• Identify the essential qualities for progressing in career.
UNIT I UNDERSTANDING AND MANAGING YOURSELF

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST


TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

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COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

UNIT 2: SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge,
performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References


HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C 3 0 0 3

COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES
UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION
As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY

OBJECTIVES
• To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
• To Foster critical thinking and imagination by dealing with inter-related concepts in literature and science.
• To bridge the gap between the sciences and humanities through introspective analyses.
• To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.
UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD

UNIT IV KNOWLEDGE AS POWER/OPPRESSION

UNIT V SELF KNOWLEDGE/BRAHMAN

TOTAL : 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge
UNIT I INTRODUCTION
Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS
Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH
Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING
Need of Counseling, Counselor and the Counsellee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS
HSMC – ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271  GENDER, CULTURE AND DEVELOPMENT       L T P C
                                        3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives
✓ To familiarize students with the concepts of sex and gender through literary and media texts.
✓ To help students ask critical questions regarding gender roles in society.
✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
✓ To help students think critically about gender based problems and solutions.

Learning Outcomes
➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
➢ Students will be able to analyse current social events in the light of gender perspectives.
➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender
• Definition of Gender
• Basic Gender Concepts and Terminology
• Exploring Attitudes towards Gender
• Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations
• Types of Gender Roles
• Gender Roles and Relationships Matrix
• Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
UNIT III: Gender Development Issues
- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence
- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture
- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

**UNIT I**  HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

**UNIT II**  CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico-spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

**UNIT III**  HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

**UNIT IV**  CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

**UNIT V**  DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

**TOTAL:** 45 PERIODS

**OUTCOMES:**
On completion of the course, the students will be able to:

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.
Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

**UNIT II | LAWS**
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

**UNIT III | BUSINESS ORGANISATIONS**
Sole traders (Business has no separate identity from you, all business property belongs to you). Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

**UNIT IV | LAW AND SOCIETY**
Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.

**UNIT V | CASE STUDIES**
Important legal disputes and judicial litigations

**TOTAL: 45 PERIODS**

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**COURSE DESCRIPTION**
This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

**OBJECTIVES:**
- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.
UNIT I  THE COMPONENTS OF FILMS  
Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II  EVOLUTION OF FILM  

UNIT III  FILMS ACROSS THE WORLD  

UNIT IV  INDIAN FILMS  

UNIT V  INTERPRETING FILMS  
Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to:

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods
- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation
- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)
- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C 3 0 0 3

OBJECTIVES
- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS :
UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW
Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive, universal-

UNIT II MORPHOLOGY - WORDS OF LANGUAGE

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :
Lectures, discussion.

Evaluation Internal and External :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)
REFERENCES:

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

UNIT I INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions - Pictography. From visual to oral - Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II READING CULTURE

UNIT III IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V RETURNING TO PICTURES

Reading list
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies
5. Shankarakcharya: Viveka Chudamani
6. Camus, Albert- The Myth of Sisyphus
7. Calvino, Italo: If on a winter’s night a traveler
OUTCOME

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.

AD5091 CONSTITUTION OF INDIA L T P C

3 0 0 0

OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES


UNIT III ORGANS OF GOVERNANCE

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS


UNIT V LOCAL ADMINISTRATION

District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level- Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.
**TEXTBOOKS:**
4. The Constitution of India (Bare Act), Government Publication, 1950

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**OBJECTIVES:**
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

**UNIT I**
INTRODUCTION TO VALUE EDUCATION
Values and self-development – Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

**UNIT II**
IMPORTANCE OF VALUES
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

**UNIT III**
INFLUENCE OF VALUE EDUCATION
Personality and Behaviour development – Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

**UNIT IV**
REINCARNATION THROUGH VALUE EDUCATION

**UNIT V**
VALUE EDUCATION IN SOCIAL EMPOWERMENT
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: Gain knowledge of self-development
CO2: Learn the importance of Human values
CO3: Develop the overall personality through value education
CO4: Overcome the self destructive habits with value education
CO5: Interpret social empowerment with value education

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AD5093 PEDAGOGY STUDIES L T P C
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OBJECTIVES:
- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.
UNIT IV PROFESSIONAL DEVELOPMENT 9
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

COURSE OUTCOMES:
CO1: Understand the methodology of pedagogy.
CO2: Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
CO3: Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
CO4: Know the factors necessary for professional development.
CO5: Identify the Research gaps in pedagogy.

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AD5094 STRESS MANAGEMENT BY YOGA L T P C
3 0 0 0

OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’t’s in life through Yam
- Categorize Do’s and Don’t’s in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

**UNIT I  INTRODUCTION TO YOGA**  9
Definitions of Eight parts of yog. (Ashtanga)

**UNIT II  YAM**  9
Do’s and Don’t’s in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**UNIT III  NIYAM**  9
Do’s and Don’t’s in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

**UNIT IV  ASAN**  9
Various yog poses and their benefits for mind & body

**UNIT V  PRANAYAM**  9
Regularization of breathing techniques and its effects - Types of pranayam

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
- CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
- CO2 – Learn Do’s and Don’t’s in life through Yam
- CO3 – Learn Do’s and Don’t’s in life through Niyam
- CO4 – Develop a healthy mind and body through Yog Asans
- CO5 – Learn breathing techniques through Pranayam

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**REFERENCES:**
1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. “Yogic Asanas for Group Training-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur

**AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT**  L T P C  3 0 0 0

**SKILLS**

**OBJECTIVES:**
- Develop basic personality skills holistically
• Develop deep personality skills holistically to achieve happy goals
• Rewrite the responsibilities
• Reframe a person with stable mind, pleasing personality and determination
• Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9
Verses- 52,53,59 (don’t’s) - Verses- 71,73,75,78 (do’s)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16, 17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWAGDEETA 9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

COURSE OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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REFERENCES:
1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam , Niti-sringar-vairagya, New Delhi,2010
COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C 3 0 0 0

Course Objectives:
The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9

UNIT II ‘AGATHINAI’ AND ‘PURATHINAI’ 9
Tholkappiyar’s Meaningful Verses–Three literature materials–Agathinai’s message- History of Culture from Agathinai–Purathinai–Classification–Mesaage to Society from Purathinai.

UNITIII ‘ATTRUPPADAI’ 9
Attruppadai Literature–Attruppadai in’Puranaanuru’-Attruppadaiin ‘Pathitrupaththu’-Attruppadai in ‘Paththu aatu’.

UNITIV ‘PURANAANURU’ 9
Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.

UNITV ‘PATHITRUPATHTHU’ 9
Pathitrupaththu in’Ettuthogai’–Pathitrupaththu’s Parables–Tamil dynasty:Valor, Administration, Charity in Pathitrupaththu- Messeage to Society from Pathitrupaththu.

TOTAL (L:45) = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitrupaththu’in their personal and societal life.

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