HALDIA INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

B. Tech in Computer Science & Engineering (Artificial Intelligence and Machine Learning)

❖ SEMESTER – III

➢ ESC-AIML-301: Digital Electronics

Contacts: 3L per week Credits: 3

Course Outcomes (COs):

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Convert a number from one base system to another.
3. Understand Boolean algebra and represent digital circuits from Boolean expressions.
4. Design and implement many Combinational circuits.
5. Design and implement various Sequential logic circuits.
6. Understand the process of Analog to Digital conversion and Digital to Analog conversion.

➢ PCC-AIML-301: Data Structure and Algorithms

Lecture per week (L – T): 3-1 Credits: 4

Course Outcomes (COs) :

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

1. Create and Design programs using a variety of data structures such as stacks, queues, hash tables, binary trees, heaps, graphs.
2. Evaluate and choose appropriate data structures to represent data items in real world.
3. Analyze the time and space complexities of algorithms.
4. Implement and apply sorting algorithms for problem solving.
5. Understand the concept of dynamic memory management.
6. Identify and remember user defined data types, linear data structures for solving real world problems.

➢ PCC-AIML-302: Computer Organization & Architecture

Contacts: 3L+1T per week Credits: 4

Course Outcomes (COs):

At the end of this course, students will demonstrate the ability to

1. Demonstrate how Computer Systems work & the basic principles
2. Understand Instruction Level Architecture and Instruction Execution
3. Understand the current state of art in memory system design
4. Demonstrate how I/O devices are accessed and its principles.
5. Impart the knowledge on micro programming control unit
6. Understand concepts of pipelining techniques.

➢ BSC-AIML-301: Linear Algebra

Lecture per week (L – T): 3-0 Credits: 3

Course Outcomes (COs):

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

1. Formulate elementary row and column operation.

2. Evaluate matrix algebra and related matrices to linear transformation.
3. Analyze singular value decomposition.
4. Solve systems of linear equations.
5. Use matrix algebra and the related matrices to linear transformations.
6. Understand the basic ideas of linear mapping.

- HSMC-AIML-301: Economics for Engineers

Contacts: 2L per week Credits: 2

Course Outcomes (COs):

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

1. Evaluate the economic theories, cost concepts and pricing policies.
2. Understand the market structures and integration concepts.
3. Understand the measures of national income, the functions of banks and concepts of globalization.
4. Apply the concepts of financial management for project appraisal.
5. Understand accounting systems and analyze financial statements using ratio analysis.
6. Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems.

- ESC-AIML-391: Digital Electronics Lab

Contacts: 3P per week Credits: 1.5

Course Outcomes (COs):

At the end of this course, students will demonstrate the ability to

1. Acquire knowledge about basics of digital electronics.
2. Explain about how to solve problems related to number systems and Boolean algebra.
3. Identify, analyze and design combinational circuits.
4. Design BCD to Excess-3 and Binary to gray code conversion circuit.
5. Compare various synchronous and asynchronous sequential circuits.
6. Analyze sequential digital circuits like flip-flops, registers, counters.

- PCC-AIML-391: Data Structure and Algorithms Lab

Labs per week (P): 3 Credits: 1.5

Course Outcomes (COs):

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

1. Design and solve programs using a variety of data structures such as stacks, queues, hash tables, binary trees, heaps, graphs.
2. Evaluate and choose appropriate data structures to represent data items in real world.
3. Analyze the time and space complexities of algorithms.
4. Implement sorting and searching algorithms for problem solving.
5. Understand the concept of dynamic memory management.
6. Identify and remember user defined data types, linear data structures for solving real world problems.

- PCC-AIML-392: Computer Architecture Lab

  Contacts: 3P per week Credits: 1.5

  Course Outcomes:

  At the end of this course, students will demonstrate the ability to

  1. Summarize Xilinx/ Altera (VHDL) foundation tools and Hardware Description Language.
  2. Demonstrate different concepts and methods of digital system design techniques through hands-on projects.
  3. Build various combinational and sequential digital systems.
  4. Identify knowledge, techniques required to design, implement and test modern day digital systems.
  5. Evaluate and interpret the results of logic and timing simulations.
  6. Analyze digital systems through hands-on experiments on the Xilinx/ Altera tools.

- PCC-AIML-393: IT Workshop (Python) Labs

  per week: 3 Credits: 1.5

  Course Outcomes (COs):

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

  1. Develop algorithmic solutions to simple computational problems.
  2. Identify and repair coding errors in a program.
  3. Demonstrate programs using simple Python statements and expressions.
  4. Explain control flow and functions concept in Python for solving problems.
  5. Use Python data structures – lists, tuples & dictionaries for representing compound data.
  6. Explain files, exception, modules and packages in Python for solving problems.

❖ SEMESTER – IV

- ESC-AIML-401: Probability and Statistics

  Lecture per week (L – T): 3-0 Credits: 3

  Course Outcomes (COs):

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

  1. Understand basic notions of probability arising in a variety of uncertain situations which are nontraditional in areas of science and engineering.
  2. Understand the concepts of Binomial and Poisson distributions – Normal distribution, Exponential distributions, Weibull distribution.
  3. Analyze the Random variables, one dimensional Random Variables, Discrete and Continuous RVDensity and Distribution function of RV.
  4. Discuss the basic ideas of Statistics.
  5. Explain the ideas of Correlation and regression. 6. Illustrate the concepts on Test of Significance, Test of Hypothesis.

- PCC-AIML-401: Object Oriented Programming & Java

  Lecture per week (L – T): 3-0 Credits: 3

  Course Outcomes (COs):

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

  1. Create and explain GUI and thread based application.

2. Evaluate the complexity of procedural language by using the concept of polymorphism, inheritance, abstraction, and encapsulation.
3. Analyze any real world problem with object oriented approach and formulate a solution for the same.
4. Implement and apply object oriented approach to relate to real world problem.
5. Understand, describe and illustrate the features of object oriented programming.
6. Recall the knowledge of procedural language and map it to paradigm of Object Oriented concept.

- PCC-AIML-403: Design and Analysis of Algorithm

Contacts: 3L + 1T per week Credits: 4

Course Outcomes (COs):

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

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Apply the algorithms and design techniques to solve problems.
3. Analyze the complexities of various problems in different domains.
4. Apply design and development principles in the construction of software systems of varying complexity.
5. Design and development principles in the construction of software systems of varying complexity.
6. Adapt current techniques, skills, and tools necessary for computing practice.

- ESC-AIML-402: Signals and Systems

Contacts: 3L per week Credits: 3

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Analyze different types of signals.
2. Represent continuous and discrete systems in time and frequency domain using different transforms.
3. Analyse systems in complex frequency domain.
4. Understand sampling theorem and its implications.
5. Investigate whether the system is stable.
6. Sampling and reconstruction of a signal.

- MC-AIML-401: Environmental Sciences

Contacts: 2L per week Credits: 0

Course Outcomes (COs):

At the end of this course, students will demonstrate the ability to

1. Acquire fundamental knowledge of different aspects of environment and local, regional and global environmental problems.
2. Get the information about ecosystem and also about its functions like Food chain, Ecological pyramids etc.
3. Obtain the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources.

4. Gain the knowledge about the ecosystem diversity, its values and also about the importance of the endemic species and different techniques involved in its conservation.
5. Gain the knowledge about the different types of pollutions and their control technologies, Waste water treatment, Bio medical waste management etc.,
6. Acquire the complete information about EIA- Environmental Impact Assessment, Sustainable developmental activities, environmental policies and regulations, awareness among people about protection of wild life, forest and other natural resources.

- PCC-AIML-491: Object Oriented Programming & Java Lab

Lab per week (P): 3 Credits: 1.5

Course Outcomes (COs):

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

1. Create multithreaded programs.
2. Evaluate the complexity of procedural language by using the concept of polymorphism, inheritance, abstraction, and encapsulation.
3. Experiment any real world problem with object oriented approach and formulate a solution for the same.
4. Implement and apply object oriented approach to relate to real world problem.
5. Understand and develop graphical user interface using AWT.
6. Recall the knowledge of event handling mechanism.

- PCC-AIML-492: Design and Analysis of Algorithm Lab

Lab per week (P): 3 Credits: 1.5

Course Outcomes (COs):

After completion of this course, the students are able to:

1) Solve problems by applying appropriate algorithms.
2) Analyze the efficiency of various algorithms.
3) Apply techniques of stacks and queues to solve problems.
4) Develop a program that can be solved in many ways using different techniques.
5) Identify and evaluate complex problems using principles of mathematics and engineering science.
6) Design a novel solution for real life problem.

❖ SEMESTER – V

- BSC-AIML-501: Discrete Mathematics

Lecture per week (L – T): 3-0 Credits: 3

Course Outcomes (COs):

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

1. Apply mathematical logic to solve problems.
2. Understand sets, relations, functions and discrete structures.
3. Use logical notations to define and reason about fundamental mathematical concepts such as sets relations and functions.
4. Identify functions and determine their properties.
5. Formulate problems and solve recurrence relations.

6. Model and solve real world problems using graphs and trees.

- PCC-AIML-501: Operating System

Contacts: 3L per weekCredits: 3

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand the mechanisms of OS to handle processes and threads and their communication
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. Demonstrate the mechanisms involved in memory management in contemporary OS
4. Understand the components and management aspects of concurrency management
5. Develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
6. Design and implement file management system.

- PCC-AIML-502: Database Management Systems

Contacts: 3L per week Credits: 3

Course Outcomes (COs):

On completion of the course students will be able to:

1. Describe the fundamental elements of relational database management systems
2. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
3. Design ER-models to represent simple database application scenarios
4. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
5. Improve the database design by normalization.
6. Understand the basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

- PCC-AIML-503: Machine Learning Foundation

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Develop an appreciation for what is involved in learning models from data.
2. Understand a wide variety of learning algorithms.
3. Understand how to evaluate models generated from data.
4. Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
5. Understand the foundation of generative models.
6. Understand algorithms for learning Bayesian networks.

- PCC-AIML-504: Computer Networks

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Design and investigate why network needs flow control and error control techniques.
2. Evaluate the performance of the different routing protocol (RIP, OSPF) based on routing cost, convergence rate and complexity to find the shortest path.
3. Analyze the pieces of hardware (hub, bridge, switch, router) to make networks more efficient, faster, more secure, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
4. Demonstrate different LLC protocols, Internet Protocol, and usage of the IP address and subnet mask to setup a network.
5. Understand various techniques (open loop and close loop) used for congestion control and quality of service (traffic scheduling and shaping).
6. Identify and remember importance of existing protocols (DNS, DHCP, FTP, WWW, HTTP) running in application layer.

- PCC-AIML-505: Artificial Intelligence

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Understand the various searching techniques, constraint satisfaction problem and example problemsgame playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real-world Knowledge representation.
5. Analyze and design a real-world problem for implementation and understand the dynamic behaviour of a system.
6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

- PCC-AIML-591: Operating System Lab

Contacts: 3P per week Credits: 1.5

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Demonstrate shell programming which include shell scripts and explaining shell syntax (variables, conditions, control structure, and functional commands).
2. Execute programs like, creating a new process, creating orphan process and zombie process, synchronizing parent and child process.
3. Analyze synchronization of co-operating processes with semaphore (semctl(), semget(), semop(), set semvalue, del semvalue, semaphore p and semaphore v).

4. Adapt concept of signals with sending signals, signal interface, and signal handling.
5. Apply POSIX threads using pthread_create, pthread_join and pthread_exit.
6. Understand Inter-Process Communication (IPC) with use of pipes, message queue etc.

- PCC-AIML-592: Database Management System Lab

Contacts: 3P per week Credits: 1.5

Course Outcomes (COs):

At the end of the course the students are able to:

1. Apply the basic concepts of Database Systems and Applications.
2. Define the basics of SQL and construct queries using SQL in database creation and interaction.
3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system.
5. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger, views and embedded SQL.
6. Construct various software to design and build ER Diagrams, UML, Flow chart for related database systems.

- PCC-AIML-593: Machine Learning Foundations Lab

Labs per week: 3 Credits: 1.5

Course Outcomes (COs):

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

1. Recognize the characteristics of machine learning that make it useful to real-world problems.
2. Implement machine learning algorithms using toolboxes.
3. Develop suitable machine learning model for real life problem solving.
4. Analyze the performance of different classifiers.
5. Analyze the performance of different clustering algorithms.
6. Evaluate the machine learning models pre-processed through various feature engineering algorithms by python programming.

❖ SEMESTER –VI

- PCC-AIML-601: Machine Learning Applications

Lectures per week: 2 Credits: 2

Course Outcomes (COs):

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

1. Describe few Machine Learning systems like recommendation systems, social graph mining.
2. Implement ML algorithms to solve real world problems.
3. Compare different solutions for a given problem in the context of performance.
4. Design a machine learning system by incorporating various components of ML and evaluate the performance.
5. Develop machine learning model for bio informatics.

6. Understand the concept of Hidden Markov model.

- PCC-AIML-602: Deep Learning

Lectures per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Recognize the characteristics of deep learning models that are useful to solve real-world problems.
2. Understand different methodologies to create application using deep nets.
3. Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
4. Implement different deep learning algorithms.
5. Design the test procedures to assess the efficacy of the developed model.
6. Combine several models in to gain better results.

- HSMC-AIML-601: Human Values and Professional Ethics

Contacts: 3L per week Credits: 3

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand Engineering and Technology as social and professional activities.
2. Demonstrate the effects of technological growth, crisis of global resources and possible way out.
3. Understand knowledge development for ethics in profession.
4. Dissect development of professional and human values.
5. Explain development of inner core and initiation of lifelong learning and survival process in professional arena.
6. Demonstrate development of Moral character and thought of development of the country.

- PEC-AIML-601A: Soft Computing

Lectures per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Characterize supervised and unsupervised learning neural networks based on its architecture, training and testing mechanism.
2. Apply the concept of fuzzification and defuzzification in fuzzy systems.
3. Classify the architecture and working principles of specialized neural networks.
4. Analyze the fundamental concepts of genetic algorithm and classify its types.
5. Design, implement and evaluate a system / computer-based system, process, component or program to meet desired needs.
6. Apply soft computing techniques to solve real time problems.

- PEC-AIML-601B: Cloud Computing

  Lectures per week (L): 3 Credits: 3

  Course Outcomes (COs):

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

  1. Discuss the core concepts of cloud computing paradigm.
  2. Analyze services, systems, platforms, frameworks to support cloud computing.
  3. Illustrate the concepts of cloud storage system services.
  4. Assess virtualization technology services in open source cloud computing environment.
  5. Understand data center technology from industry centric perspective.
  6. Identify cloud security issues to demonstrate real time applications.

- PEC-AIML-601C: Pattern Recognition

  Contact: 3L Credits: 3

  Course Outcomes:

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

  1. Realize the clustering concepts and algorithms
  2. Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
  3. Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
  4. Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
  5. Execute pattern recognition techniques to real-world problems such as document analysis and recognition.
  6. Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

- PEC-AIML-601D: Graph Theory

  Contact: 3L Credits: 3

  Course Outcomes (COs):

  Upon completion of this course, the students should be able to:

  1. Understand the various types of graph Algorithms and graph theory properties.
  2. Analyze the NP – complete problems.
  3. Distinguish the features of the various tree and matching algorithms
  4. Appreciate the applications of digraphs and graph flow.
  5. Understand the linear programming principles and its conversion.
  6. Apply suitable graph model and algorithm for solving applications.

- PEC AIML-602A: Big Data Analytics

  Lecture per week: 3 Credits: 3

  Course Outcomes (COs):

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

  1. Understand the concept of data management and evolution of Big Data.
  2. Understand and implement various big data technology foundations.
  3. Apply the fundamentals of Hadoop ecosystem and its components for data analysis.

4. Analyze the optimization techniques in data bases.
5. Analyze the storage techniques in data bases.
6. Explore the understanding of text, sentiment analytics.

- PEC-AIML-602B: Data Mining

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Understand what Is Data Mining, what kinds of data can be mined, what kinds of patterns can be mined, and what kinds of applications are targeted.
2. Explain major Issues in data mining.
3. Apply machine learning, pattern recognition, statistics, visualization, algorithm, database technology and high-performance computing in data mining applications.
4. Identify what kinds of technologies are used for different application.
5. Manipulate data preprocessing, data Warehouse and OLAP technology, data cube technology; mining frequent patterns and association, classification, clustering, and outlier detection.
6. Discover interesting patterns from large amounts of data to analyze for predictions and classification.

- PEC-AIML-602C: Distributed System

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Understand the basic knowledge of Distributed Computing.
2. Understand the Distributed Models.
3. Compare interposes communication and remote communication.
4. Remember the concept of service oriented architecture.
5. Apply different emerging techniques in distributed computing.
6. Design Distributed Shared Memory and File System.

- PEC-AIML-602D: Digital Signal Processing

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Design linear discrete-time systems and filters and analyse their behaviour.
2. Represent continuous-time signals and linear systems in discrete time, so that such signals can be recovered in continuous time when necessary.
3. Compute approximations to Fourier transforms of continuous-time signals with finite discrete time methods.
4. Understand the analytical tools such as Fourier transforms, Discrete Fourier transforms, Fast Fourier Transforms and Z-Transforms required for digital signal processing.
5. Design and realize various digital filters for digital signal processing.
6. Understand the applications of DSP in speech processing and spectrum analysis.

- ## OEC-AIML-601A: Advanced Computer Architecture

  Contacts: 3L per week Credits: 3

  ### Course Outcomes:

  At the end of this course, students will demonstrate the ability to

  1. Explain various parameters to measure the performance of a processor.
  2. Demonstrate the parallel computing concepts and compare parallel computing with sequential computing.
  3. Explain the pipelining technique and its related issues.
  4. Demonstrate the vector processing, array processors and multiprocessors.
  5. Outline and design various types of interconnection networks for parallel computers.
  6. Dissect different techniques required to improve the performances of cache memory and main memory.

- ## OEC-AIML-601B: Human Computer Interaction

  Lecture per week (L): 3 Credits: 3

  ### Course Outcomes (COs):

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

  1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
  2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
  3. Apply an interactive design process and universal design principles for designing HCI systems.
  4. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.
  5. Apply design and development principles in the construction of HCI systems
  6. Use current techniques, skills, and tools necessary for computing practice.

- ## OEC-AIML-601C: Artificial Neural Network

  Lecture per week (L): 3 Credits: 3

  ### Course Outcomes (COs):

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

  1. Analyze synaptic connectivity as the basis of neural computation and learning
  2. Evaluate the ideological basics of artificial neural networks
  3. Understand the origins of artificial neural networks
  4. Know some application of artificial neural networks
  5. Identify the different structures of artificial neural networks.
  6. Learn perceptron and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation.

- ## OEC-AIML-601D: Cryptography and Network Security

  Lecture per week (L): 3 Credits: 3

  ### Course Outcomes (COs):

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

1. Design network application security schemes, such as PGP, S/MIME, SSL, HTTPS etc.
2. Evaluate concepts of Firewall (including types of Firewall), DMZ Network and comparing between different Firewall Configurations.
3. Analyze Biometric Authentication and differentiate between different types of Authentication tokens.
4. Implement and apply numerical module based on DES and RSA illustrating the concept of SSL, PGP, Authentication token, Digital Signature, Message Digest and Hash function.
5. Understand and Classify different kinds of Substitution techniques and Transposition techniques and discuss the concepts of Symmetric key cryptography and Asymmetric key cryptography.
6. Define the concepts of Network security and identifying different types of attack on Network security.

- PCC-AIML-691: Machine Learning Applications Lab

Labs per week: 3 Credits: 1.5

Course Outcomes (COs):

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

1. Develop Machine learning models.
2. Apply the knowledge of machine learning in various practical fields.
3. Design machine learning algorithms to solve real life problems.
4. Understand different machine learning techniques.
5. Analyze and compare the performance of different Machine learning algorithms.
6. Remember the concept of Machine learning model selection.

- PCC-AIML-692: Artificial Intelligence Lab

Labs per week (L): 3 Credits: 1.5

Course Outcomes (COs):

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

1. Demonstrate the applications of AI and agent-based approach to AI.
2. Obtain first-order predicate calculus, logical reasoning and problem solving using Python language.
3. Study and discuss various techniques and algorithms of AI used in general problem solving, optimization problems, constraint satisfaction problems, and game programming.
4. Familiarize students with various sub-areas of AI, such as expert systems, natural language processing and machine learning.
5. Study and discuss various techniques and algorithms of AI used in Genetic Algorithm.
6. Dissect various techniques and algorithms of AI used in Expert System.

- PCC-AIML-693: Computer Networks Lab

Labs per week (P): 3 Credits: 1.5

Course Outcomes (COs):

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

1. Design an application to execute command remotely using socket programming.
2. Evaluate file transfer application using socket programming.

3. Analyze the hardware (hub, bridge, switch, router) to make networks more efficient, faster, more secure, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
4. Implement error-control mechanism for data transmission.
5. Understand the concepts of NIC installation and configuration.
6. Remember to gather network information using socket programming.

❖ SEMESTER –VII

➢ PEC-AIML-701A: Social Network Analysis

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Understand the concept of semantic web and related applications.
2. Learn knowledge representation using ontology.
3. Understand human behaviour in social web and related communities.
4. Learn visualization of social networks.
5. Develop semantic web related applications.
6. Represent knowledge using ontology.

➢ PEC-AIML-701B: Computer Vision

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

Upon completion of the course, students will be able to

1. Understand and master basic knowledge, theories and methods in image processing and computer vision.
2. Identify, formulate and solve problems in image processing and computer vision.
3. Analyze, evaluate and examine existing practical computer vision systems.
4. Critically review and assess scientific literature in the field and apply theoretical knowledge to identify the novelty and practicality of proposed methods.
5. Design and develop practical and innovative image processing and computer vision applications or systems.
6. Conduct themselves professionally and responsibly in the areas of computer vision image processing and deep learning.

➢ PEC-AIML-701C: Software Engineering

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Describe the importance of software engineering lifecycle models in the development of software and apply the knowledge to the solution of complex engineering problems.
2. Analyze the requirements and develop SRS documents following the principles in modeling software based on real life applications.
3. Design and develop software which adheres to the standard software design guideline & benchmarks.
4. Create and apply appropriate techniques for software testing.

5. Demonstrate knowledge and understanding of engineering and management principles for software projects management.
6. Understand software matrices like size, effort and cost estimation, and software quality metrics.

- PEC-AIML-701D: Data Warehousing

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Define the knowledge of mathematics and science on data warehouse, building blocks, Data Mart and recall in independent and life-long learning of data warehouse.
2. Classify Data warehouse Architecture in the areas of Data acquisition, Data storage and Information delivery and illustrate the engineering principles.
3. Make use of the architecture and infrastructure of Database Software and model appropriate tools for database software by applying the knowledge of software development by individual or team.
4. Analyze Metadata types by functional areas and assume effective reports on Business metadata by understanding of the engineering principles of metadata.
5. Justify effective reports on Data acquisition, Data storage, and Information delivery and evaluate the ability for life-long learning on data storage.
6. Discuss Knowledge Discovery Process, OLAP, Different techniques by building the knowledge of mathematics and engineering fundamentals on OLAP and develop applications in societal, health, safety, legal and cultural issues.

- PEC-AIML-702A: Ecommerce and ERP

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Understand fundamental concepts and technologies related to ERP.
2. Explain the different phases of ERP implementation life cycle.
3. Examine the modules, benefits and various tools of ERP.
4. Analyze the impact of e-commerce on business model and strategies.
5. Assess the electronic payment systems and software.
6. Identify and solve the security issues related to communication.

- PEC-AIML-702B: Information Theory and Coding

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Apply various source coding techniques.
2. Design the channel performance using information theory.
3. Comprehend various error control code properties
4. Apply linear block codes for error detection and correction

5. Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

6. Design BCH & RS codes for channel performance improvement against burst errors.

- PEC-AIML702C: Data Visualization

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Identify the different data types, visualization types to bring out the insight.

2. Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.

3. Design visualization dashboard to support the decision making on large scale data. 4. Demonstrate the analysis of large dataset using various visualization techniques and tools.

5. Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data.

6. Create and interpret plots using R/Python.

- PEC-AIML-702D: Mobile Computing

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Understand the necessary knowledge of cellular communication, infrastructure-less networks

2. Analyze TCP, MAC protocols and their technical feasibility

3. Analyze device independent applications

4. Acquire knowledge about the basic concepts and principles in mobile computing

5. Understand techniques involved, in networks

6. Analyze systems issues for the design and implementation of mobile computing systems.

- OEC-AIML-701A: Internet of Things

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Understand the vision of IoT from a global context.

2. Determine the Market perspective of IoT.

3. Design Devices, Gateways and Data Management in IoT.

4. Building state of the art architecture in IoT.

5. Apply IoT in Industrial and Commercial Building Automation and Real-World Design

6. Evaluate the performance of IoT devices.

- OEC-AIML-701B: Bioinformatics

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Design basic algorithms used in Pairwise and Multiple alignments.
2. Understand the methodologies used for database searching, and determining the accuracies of database search.
3. Application of probabilistic model to determine important patterns.
4. Prediction of structure from sequence and subsequently testing the accuracy of predicted structures.
5. Determine the protein function from sequence through analyzing data.
6. Analysis and development of models for better interpretation of biological data to extract knowledge.

- OEC-AIML-701C: Robotics

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Perform kinematic and dynamic analyses with simulation.
2. Design control laws for a robot.
3. Apply sensor and vision system for controlling a robot.
4. Integrate mechanical and electrical hardware for a real prototype of robotic device.
5. Develop mathematical model to represent dynamic system.
6. Select a robotic system for given application.

- OEC-AIML-701D: Compiler Design

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Describe the compilation phases, input and output of each phases, recognizing different possible errors detected by different phases..
2. Design a DFA to recognize partial keywords of C programming language and lexical analyzer, automated lexical analyzer using LEX, and FLEX.
3. Understand the role of a parser, syntax analysis phase, top-down parsing and bottom-up parsing techniques and automated parser generation tool: YACC.
4. Realize and explain the role of semantic analysis phase with data type handling issues, associated actions with CFG rules using SDD and SDT.
5. Understand different ways of intermediate code generation techniques and intermediate representation of any high-level language code segment, and run-time environment issues during compilation.
6. Develop the knowledge of code optimization and code generation issues, construct flow graphs and DAG representation of basic blocks, and register allocation and assignment.

- HSMC-AIML-701: Principles of Management

Contacts: 3L per week Credits: 3

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Learn the basic concept of management, function of management, planning, organizational structure, and organizational effectiveness.

2. Understand in depth relationship of management and society.
3. Express knowledge of people management & managerial competency.
4. Understand leadership theory, decision making process & knowledge development in economic, financial and quantitative analysis.
5. Learn about market and customer management.
6. Demonstrate in-depth knowledge of operation, technology management and different quality assurance drivers in the industry and their practical usage.

❖ SEMESTER –VIII

➢ PEC-AIML-801A: Natural Language Processing

Contacts: 3L per week Credits: 3

Course Outcomes (COs):

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

1. Justify the various steps necessary for processing natural language.
2. Suggest appropriate lexical and parsing techniques for a given natural language.
3. Apply appropriate statistical models for a given natural language application.
4. Modify existing algorithms to suit any natural language for processing
5. Recommend appropriate pre-processing steps essential for the various applications involving natural language processing.
6. Design applications involving natural language.

➢ PEC-AIML-801B: Ethical Issues in AI

Contacts: 3L per week Credits: 3

Course Outcomes (COs):

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

1. Describe knowledge of philosophical issues involved in ethics of artificial intelligence.
2. Demonstrate familiarity with relevant examples of AI systems.
3. Value the ability to work in a small team.
4. Develop written work regularly to a deadline.
5. Acquire ability to express arguments clearly and concisely.
6. Construct skills in research, analysis and argumentation.

➢ PEC-AIML-801C: Digital Image Processing

Contacts: 3L per week Credits: 3

Course Outcomes (COs):

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

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.

- PEC-AIML-801D: Applications of AI in Biomedical Engineering

  Lecture per week (L): 3 Credits: 3

  Course Outcomes (COs):

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

  1. Understand models of human and artificial intelligence, specifically computational models of intelligence.
  2. Comprehend a collection of machines learning models (identified and covered in the course), and their applications in medicine and healthcare.
  3. Identify and apply appropriate intelligent system models and computational tools to specific problems in biomedicine and healthcare.
  4. Analyze the performance of specific models as applied to biomedical problems, and justify their use and limitations.
  5. Identify, understand, and interpret methods and evidence from artificial intelligence and other relevant literature.
  6. Effectively communicate and disseminate knowledge in any science or engineering domain in the context of computing, systems, and/or biomedical applications.

- OEC-AIML-801A: Operation Research

  Lecture per week (L): 3 Credits: 3

  Course Outcomes (COs):

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

  1. Design linear programming tools for optimal utilization of resources in various types of industries.
  2. Evaluate transportation problems to minimize cost and understand the principles of assignment of jobs and recruitment polices.
  3. Analyze decision making under certainty, uncertainty and conflicting situations.
  4. Apply forecasting methods for predicting demands.
  5. Understand the basic elements of a Queuing model.
  6. Remember and Define PERT/CPM technique for project scheduling and resource allocation in an optimal way.

- OEC-AIML-801B: Economic Policies in India

  Lecture per week (L): 3 Credits: 3

  Course Outcomes (COs):

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

  1. Assemble ideas of the basic characteristics of Indian economy, its potential on natural resources.
  2. Evaluate land reforms and green revolutions.
  3. Analyze critical assessment of Economic Reforms.
  4. Interpret the importance, cause and impact of population growth and its distribution, translate and relate them with economic development.
  5. Understand economic planning and developmental issues.
  6. Remember WTO and Indian agriculture issues.

- OEC-AIML-801C: Microelectronics and VLSI

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Have a basic understanding of the MOS device physics, its working as well as its secondary effects.
2. Design a CMOS circuit for any logic function.
3. Design circuits using alternate logic styles
4. Design and analyze the circuit parameters like delay and power.
5. Draw the layout for combinational logic circuits manually and using tools.
6. Use modern simulation tools to verify the functionality of a circuit.

- OEC-AIML-801D: Quantum Computing

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Explain the working of a Quantum Computing program, its architecture and program model.
2. Develop quantum logic gate circuits.
3. Design different mathematical foundation for quantum computing.
4. Develop quantum computing algorithm.
5. Program quantum algorithm on major toolkits.
6. Find different quantum computational complexity.

- OEC-AIML-802A: Organizational Behaviour

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Discuss the development of the field of organizational behaviour and explain the micro and macro approaches
2. Analyze and compare different models used to explain individual behaviour related to motivation and rewards
3. Identify the processes used in developing communication and resolving conflicts
4. Explain group dynamics and demonstrate skills required for working in groups (team building)
5. Evaluate the various leadership styles and the role of leaders in a decision making process.
6. Design the implementation of organizational change.

- OEC-AIML-802B: Human Resource Management

Lecture per week (L): 3 Credits: 3

Course Outcomes (COs):

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

1. Demonstrate an understanding of key terms, theories/concepts and practices within the field of HRM
2. Design competence in development and problem-solving in the area of HRM
3. Formulate innovative solutions to problems in the fields of HRM

4. Identify and appreciate the significance of the ethical issues in HR
5. Analyze the problem and issues related to human resources in an organization.
6. Integrate the understanding of various HR concepts along with the domain concept in order to take correct business decisions.

- OEC-AIML-802C: Research Methodology

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Discuss different methodologies and techniques used in research work.
2. Explain basic computer skills necessary for the conduct of research.
3. Explain key research concepts and issues.
4. Select and define appropriate research problem and parameters.
5. Develop the required numerical skills necessary to carry out research.
6. Develop an appropriate framework for research studies.

- OEC-AIML-802D: Soft Skill and Interpersonal Communication

Lecture per week: 3 Credits: 3

Course Outcomes (COs):

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

1. Develop effective communication skills (spoken and written).
2. Develop effective presentation skills.
3. Develop all-round personalities with a mature outlook to function effectively in different circumstances.
4. Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets.
5. Improve self-confidence.
6. Become more effective individual through goal/target setting, self-motivation and practicing creative thinking.