M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: B. Tech. in Artificial Intelligence and Machine Learning

Programme Code: 410

Programme Outcome (PO)

Programme Specific Outcome (PSO)

Program Educational Objectives (PEO)

Course Outcomes (CO)

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Faculty of Engineering and Technology
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Bangalore-560058

Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Approved in 23rd ACM (Resolution 23.05) held on 15th July 2021

Faculty of Engineering and Technology (FET)

Programme Name: B. Tech. (Artificial Intelligence and Machine Learning)

Programme Outcomes (POs)

B. Tech. graduates will be able to:

PO-1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO-2. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO-3. Design solutions for complex engineering problems and design system componentsor processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO-4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions

PO-5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO-6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO-7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO-8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO-9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO-10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and giveand receive clear instructions

PO-11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, tomanage projects and in multidisciplinary environments

PO-12. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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Programme Specific Outcomes (PSOs)

At the end of the B. Tech. (Artificial Intelligence and Machine Learning) Programme, the graduatewill be able to:

PSO-1. Apply principles and best practices in design of efficient algorithms and correctprograms; build reliable, secure and robust software, making use of knowledge of computer architecture, systems software , networking, Web technologies distributed computing

PSO-2. Use knowledge gained in both breadth courses in science and engineering and depthcourses in mathematics and computing, solving problems of relevance to society, industry and R&D in an innovative manner

PSO-3. Engage in lifelong learning by applying knowledge of fields of computer science and refining it and evangelizing applications and technologies to all interested communities

Program Educational Objectives (PEOs)

The objectives of the B. Tech. (Artificial Intelligence and Machine Learning) Programme are to:

PEO-1. Provide students with a strong foundation in mathematics and computing along withbreadth and foundational requirement in computing, science, engineering and humanities to enable them to devise and deliver efficient and safe solutions to challenging problems in Computer Science and inter-disciplinary areas

PEO-2. Impart analytic and cognitive skills required to develop innovative solutions for R&D,to build creative, dependable and safe products for Industry based on dynamic societal requirements motivated and nurtured by sound theoretical and practical knowledge of time tested and long lasting principles of computer science, current tools and technologies

PEO-3. Develop managerial and entrepreneurial skills inculcating strong human values alongwith social, interpersonal and leadership skills required for professional success in evolving global professional environments

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 1 (MTB101A)

After the successful completion of this course, the student will be able to:

CO-1. State and discuss basic concepts related to single, two variable calculus and matrix algebra

CO-2. Perform basic operations of matrix algebra and apply them to solve systems of linear equations

CO-3. Solve simple mathematical problems associated with linear algebra, single and two variable calculus

CO-4. Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization

CO-5. Solve complex real-world problems associated with linear algebra, single and two variable calculus

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Course Outcomes (COs)

Course Title & Code: Engineering Physics and Laboratory (PYB102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-2.** Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them
- **CO-3.** Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
- **CO-4.** Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics
- **CO-5.** Plan the experimental set-up, conduct experiments, calculate and plot the graphs to obtain the results and write a laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Engineering Mechanics (CEF101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
- **CO-2.** Interpret standard mathematical relationships and apply for solving simple static and dynamic problems in engineering mechanics
- **CO-3.** Calculate moment of inertia, determine centroid, centre of gravity for the structural members
- **CO-4.** Apply the laws of statics and dynamics for the equilibrium analysis of rigid bodies with and without friction
- **CO-5.** Apply energy methods in analyzing of static and dynamic aspects of engineering structures made of rigid bodies

Course Outcomes (COs)

Course Title & Code: Elements of Electronics Engineering and Laboratory (ECF102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
- **CO-2.** Derive mathematical relationships for electronic devices and circuits
- **CO-3.** Solve simple numerical and design problems related to analog / digital circuits as well as devices
- **CO-4.** Design and analyse operation of standard analog / digital circuits for a given application
- **CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
- **CO-6.** Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Engineering Drawing (MEF103A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the conventions used in projections of geometric entities and interpret the same
- **CO-2.** Draw orthographic projections for the geometric entities in specified positions
- **CO-3.** Develop lateral surfaces of un-sectioned and sectioned regular solids
- **CO-4.** Develop orthographic projections for given applications
- **CO-5.** Draw isometric projections for the solids and their combinations
- **CO-6.** Demonstrate competency in using CAD tool for drawing projections of geometric entities

Course Outcomes (COs)

Course Title & Code: Constitution, Human Rights and Law (LAN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the key principles of the Indian Constitution
- **CO-2.** Explain Indian legal system and judicial structure that govern the citizens
- **CO-3.** Discuss UN Declaration of Human Rights
- **CO-4.** Discuss the scope and application of Human Rights Principles and Law
- **CO-5.** Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 2 (MTB102A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamentals of ordinary differential equations and Laplace transform
- **CO-2.** Solve standard forms of ordinary differential equations
- **CO-3.** Solve simple problems in ordinary differential equations and Laplace transform
- **CO-4.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform
- **CO-5.** Apply Laplace transform in solving complex real world engineering problems

Course Outcomes (COs)

Course Title & Code: Engineering Chemistry and Laboratory (CYB104A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
- **CO-2.** Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary - secondary batteries, batteries - fuel cells, electroplating – electro less plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion

CO-3. Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology

CO-4. Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications

CO-5. Derive kinetic rate equations for various chemical systems and equation for electromotive force

CO-6. Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion and metal finishing

CO-7. Plan the experimental set up, conduct experiments, calculate and plot the graphs to obtain results, and write a laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Mechanical Engineering and Workshop Practice (MEF104A)

After the successful completion of this course, the student will be able to:

CO-1. Demonstrate the understanding on Classification of energy sources, energy conversion systems, mechanical power transmission systems, machine tools and processes

CO-2. Describe various energy conversion systems, mechanical power transmission systems and machine tools

CO-3. Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations

CO-4. Solve numerical problems on IC engines and mechanical power transmission systems

CO-5. Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

Course Outcomes (COs)

Course Title & Code: Elements of Electrical Engineering and Laboratory (EEF105A)

After the successful completion of this course, the student will be able to:

CO-1. State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements

CO-2. Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications

CO-3. Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines

CO-4. Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines

CO-5. Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values

CO-6. Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Elements of Computer Science and Engineering and Laboratory (CSF106A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the elements and methodology of Computer Science and Engineering
- **CO-2.** Explain the basic principles and techniques of algorithms and programming
- **CO-3.** Select appropriate approach to solve a computational problem
- **CO-4.** Design an algorithmic solution and draw a flow chart of the solution
- **CO-5.** Develop computer programs for moderately complex problems
- **CO-6.** Test and validate developed computer programs

Course Outcomes (COs)

Course Title & Code: Professional Communication (TSN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Apply the concepts of grammar for communication
- **CO-2.** Compose precise paragraphs
- **CO-3.** Demonstrate professional etiquette
- **CO-4.** Demonstrate appropriate verbal and non-verbal communication in the given context
- **CO-5.** Develop professional written document

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics – 3 (MTF201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** State and explain the important theorems in Fourier series, transforms and vector integral calculus
- **CO-2.** Solve simple problems in Fourier series, transforms and vector calculus
- **CO-3.** Apply Fourier series, transforms and vector calculus in solving complex real world engineering problems
- **CO-4.** Implement the programs to solve system of linear equations and non-linear equations of single variable using MATLAB
- **CO-5.** Apply interpolation and numerical integration method in analyzing some real world problems

Course Outcomes (COs)

Course Title & Code: Basics of Operating Systems (AIC201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the basic concepts, principles of operating systems and different types of operating systems
- **CO-2.** Discuss the structure of operating system, its services and system calls used for various

services such as Process management, Memory management, File Management, I/O management, Directory management and File system management

CO-3. Apply learning from system calls, shell commands and Android user API's for the suitability of an application

CO-4. Analyze the requirements and develop simple user interface application on Android platform

Course Outcomes (COs)

Course Title & Code: Mathematics for Machine Learning-I (AIC202A)

After the successful completion of this course, the student will be able to:

CO-1. To explain the foundations and pillars of Machine Learning along with the mind map of concepts of linear algebra, vector calculus and probability and statistics with applications in machine learning; also to explain and apply the concepts of set theory, functions and relations.

CO-2. To apply the concepts of linear algebra and explain its application to machine learning

CO-3. To apply the concepts of Analytic Geometry and explain its application to Machine learning

CO-4. To discuss the concepts of Vector Calculus and its role in Gradient Descent Algorithm

CO-5. To apply basic concepts of probability, Baye's Rule and explain their role in Machine Learning

Course Outcomes (COs)

Course Title & Code: Data Structures Foundation (CSD201A)

After the successful completion of this course, the student will be able to:

CO-1. Describe Linear and Non- Linear data structures such as Stacks, Queues, Linked Lists and Trees

CO-2. Explain the approaches used to implement the data structures

CO-3. Discuss the working of standard data access and manipulation algorithms

CO-4. Implement Stacks, Queues, Linked Lists and Trees

CO-5. Recommend a suitable data structure and algorithm for modeling a given scenario

CO-6. Develop computer programs using data structures to solve moderately complex problems

Course Outcomes (COs)

Course Title & Code: Logic Design (CSD202A)

After the successful completion of this course, the student will be able to:

CO-1. Describe the elements of switching and digital design

CO-2. Explain the principles and techniques of sequential and combinational logic circuits

CO-3. Apply principles of sequential and combinational logic to design digital circuits

CO-4. Analyze and optimize digital logic circuits

CO-5. Design the digital components of a computer using digital logic circuits

CO-6. Test and validate digital logic circuits

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Course Outcomes (COs)

Course Title & Code: Principles of Artificial Intelligence (AID201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts of artificial intelligence and intelligent agents
- **CO-2.** Explain the principles of knowledge representation, search strategies, learning, reasoning and planning
- **CO-3.** Apply the principles of knowledge representation, search strategies, learning, reasoning and planning to design intelligent agents
- **CO-4.** Analyze a scenario and identify strategies for knowledge representation, search, learning, reasoning and planning
- **CO-5.** Synthesize an intelligent agent for a given scenario
- **CO-6.** Evaluate the performance of an intelligent agent based on appropriate measures of performance

Course Outcomes (COs)

Course Title & Code: Innovation and Entrepreneurship (BAU201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the concepts and process of Innovation as well as entrepreneurship
- **CO-2.** Construct and apply the idea generation techniques
- **CO-3.** Discuss the opportunities for launching of new venture and various entry strategies
- **CO-4.** Examine innovative ideas for the creation and management of entrepreneurship
- **CO-5.** Formulate and present a viable business plan to the investors' appraisal

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence Laboratory (AID202A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the process of modelling, design and synthesis of artificial intelligence applications
- **CO-2.** Explain the principles of artificial intelligence and intelligent agents
- **CO-3.** Apply the principles of knowledge representation, search strategies, learning, reasoning, and planning to design intelligent agents
- **CO-4.** Analyze a scenario and identify methods for knowledge representation, search, learning, reasoning, and planning
- **CO-5.** Synthesize an intelligent agent for a given scenario
- **CO-6.** Evaluate the performance of an intelligent agent based on appropriate measures of performance

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Course Outcomes (COs)

Course Title & Code: Python and Data Structures Laboratory (CSD204A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Identify fundamental data structures and algorithms to solve a given problem
- **CO-2.** Illustrate the working of different data structures
- **CO-3.** Develop algorithms and programs to solve a given problem using appropriate data structures
- **CO-4.** Design and develop solution for efficient sorting and searching operations
- **CO-5.** Evaluate the empirical performance of implemented data structures and algorithms
- **CO-6.** Document work done and prepare a laboratory report

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 1

After the successful completion of this course, the student will be able to:

- **CO-1.** State and explain the important theorems and solve simple mathematical problems in one variable calculus and vector algebra
- **CO-2.** State theorems and solve simple problems in two variable calculi
- **CO-3.** Solve complex real-world problems associated with one and two real analysis
- **CO-4.** Illustrate fundamentals of MATLAB programming and write simple programs
- **CO-5.** Solve complex mathematical problems associated with linear algebra and compare the results with those of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics – 4 (MTF202A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Define and explain the concepts of correlation, regression, random variables, probability distribution, partial differential equations and complex analysis
- **CO-2.** State theorems and solve simple problems in partial differential equations, complex analysis, probability, probability distributions
- **CO-3.** Apply numerical methods to solve ordinary and partial differential equations using MATLAB
- **CO-4.** Solve complex engineering problems associated with numerical methods using MATLAB
- **CO-5.** Analyze real world problems associated with probability, probability distributions, partial differential equations and complex analysis
- **CO-6.** Construct the Bar chart, pie chart, Histogram, Boxplot and fitting of curves by using MATLAB

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Course Outcomes (COs)

Course Title & Code: Machine Learning-I (AIC203A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain the principles of Machine learning
- **CO-2.** Analyze the performance parameters of machine Learning
- **CO-3.** Apply naive Bayes' classifier or Nearest-Neighbor Classifiers to solve simple classification problems
- **CO-4.** Apply Linear Regression to solve the regression problems
- **CO-5.** Apply dimensionality reduction techniques.
- **CO-6.** Apply the k-means algorithm for Unsupervised Learning.

Course Outcomes (COs)

Course Title & Code: Mathematics for Machine Learning-II (AIC204A)

After the successful completion of this course, the student will be able to:

- **CO-1.** To explain the foundations and pillars of Machine Learning along with the mind map of concepts of probability and statistics and Optimization with applications in machine learning Classify and describe types of digital circuits
- **CO-2.** To apply the concepts of probability and statistics further using concepts such as Bayes' theorem, Gaussian distribution and explain applications to machine learning Analyze practical problems and develop logic design to solve the problems
- **CO-3.** To discuss optimization from the perspective of machine learning using univariate, bivariate and multi-variate optimization techniques
- **CO-4.** To apply the concepts of optimization such as Stochastic Gradient Descent used in Regression and Support Vector Machines; to discuss least-squares regression problem
- **CO-5.** To discuss Advanced Optimization Solutions, Constrained Optimization and Duality; to discuss basics of computational graphs

Course Outcomes (COs)

Course Title & Code: Design and Analysis of Algorithms (CSD206A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts of design of algorithms
- **CO-2.** Explain the principles of analysis of algorithms
- **CO-3.** Choose appropriate techniques for design and analysis of algorithms for a given problem
- **CO-4.** Analyze the worst case and average case complexity of a given algorithm
- **CO-5.** Design efficient algorithms for a given problem
- **CO-6.** Compare algorithms based on appropriately chosen measures of complexity

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Course Outcomes (COs)

Course Title & Code: Programming Paradigms (CSD207A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe and distinguish the concepts and features of various programming paradigms
- **CO-2.** Discuss the features of functional, object oriented, and event driven programming paradigms
- **CO-3.** Apply concepts of functional, object oriented, and event driven programming
- **CO-4.** Analyze the usefulness of a programming paradigm based on ease of expression and scale of development effort
- **CO-5.** Design software applications using functional, object oriented, and event driven approaches
- **CO-6.** Synthesize software applications using functional, object oriented, and event driven approaches

Course Outcomes (COs)

Course Title & Code: Environmental Studies (BTN101A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Illustrate the multidisciplinary nature of environmental studies and recognize the need for public awareness
- **CO-2.** Explain the various natural resources and their associated problems, ecosystem, and environmental pollution
- **CO-3.** Analyse the concept of ecosystem and classify various types
- **CO-4.** Compare biodiversity at local, national, and global levels
- **CO-5.** Discuss various social issues pertaining to the environment including sustainable development and energy issues

Course Outcomes (COs)

Course Title & Code: Machine Learning Algorithms Laboratory (AIL201A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Getting to know fundamentals of Tensor Flow
- **CO-2.** Illustrate the working of Decision Tree with Tensor Flow
- **CO-3.** Develop algorithms and programs to solve a given problem using MLP
- **CO-4.** Design and develop naïve Bayesian Classifier model.
- **CO-5.** Design and develop k-Means algorithm.
- **CO-6.** Design and develop K-Nearest Neighbors algorithm.
- **CO-7.** Document work done and prepare a laboratory report

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Course Outcomes (COs)

Course Title & Code: Programming Paradigms Laboratory (CSD208A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Relate the concepts of programming paradigm with the constructs of the programming language
- **CO-2.** Express the model of an application as a program in functional and object-oriented programming languages
- **CO-3.** Apply event handling and exception handling techniques in programs
- **CO-4.** Analyze a given application and suggest programming approach and language based on ease of expression and scale of development
- **CO-5.** Evaluate the usefulness of a programming approach and language for a given application requirement
- **CO-6.** Document work done and prepared a laboratory report

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 2

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamentals of ordinary differential equations State theorems and solve simple problems in two variable calculus
- **CO-2.** Solve standard forms of ordinary differential equations Illustrate fundamentals of Linear algebra
- **CO-3.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations
- **CO-4.** Apply numerical methods to solve nonlinear equations in one variable, system of linear equations, interpolation and numerical quadrature, and implement the same using MATLAB
- **CO-5.** Solve complex problems associated with nonlinear equations and linear systems, interpolation and numerical integration using MATLAB

Course Outcomes (COs)

Course Title & Code: Machine Learning-II (AIC205A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the concepts of Neural networks.
- **CO-2.** Discuss the principles of Back propagation Algorithm.
- **CO-3.** Discuss the concepts of Radial Basis Neural networks
- **CO-4.** Discuss the principles of Support Vector Machines.
- **CO-5.** Discuss Unsupervised Learning Techniques.

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Course Outcomes (COs)

Course Title & Code: Data Mining (CSC302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the conceptual framework of classification and clustering
- **CO-2.** Explain the principles of supervised and unsupervised learning algorithms, training and test data
- **CO-3.** Apply machine learning techniques to solve problems of practical importance
- **CO-4.** Analyse the given data using classification and clustering algorithms
- **CO-5.** Synthesise and solve data mining problems of practical importance using theoretical analysis and software tools

Course Outcomes (COs)

Course Title & Code: Microprocessors and Architecture (CSD203A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the architecture of CPU, memory and I/O subsystems
- **CO-2.** Explain the concepts and working of computer architectural subsystems
- **CO-3.** Apply concepts of architecture to design simple architectural components
- **CO-4.** Analyze, test and validate simple processor design
- **CO-5.** Design the main functional units of architectural subsystems
- **CO-6.** Select appropriate architectural features for a given application

Course Outcomes (COs)

Course Title & Code: Computer Networks (CSD301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the protocols that operate in the TCP/IP stack and Wireless networks
- **CO-2.** Explain the typical applications of computer networks along with the protocols and security considerations
- **CO-3.** Choose appropriate network protocols for given applications
- **CO-4.** Compare and analyze different wired and wireless network protocols for given application requirements
- **CO-5.** Design different types of servers using appropriate transport layer protocols based on application requirements
- **CO-6.** Synthesize client-server based computer networks using the sockets API

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Course Outcomes (COs)

Course Title & Code: Database Systems (CSC302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts, design and applications of database systems
- **CO-2.** Explain the principles of data modelling, querying, storage, transactions and optimization of database systems
- **CO-3.** Analyse the schema and use appropriate normalization techniques for relational databases
- **CO-4.** Develop queries using query languages for a given database system
- **CO-5.** Apply principles of database systems to model data and create queries
- **CO-6.** Design and implement an efficient database system and interface it with a given application

Course Outcomes (COs)

Course Title & Code: Microprocessors Laboratory (CSD205A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the elements of assembly language programming
- **CO-2.** Discuss the various tools and techniques used for assembly language programming
- **CO-3.** Apply assembly language constructs to optimize C programs
- **CO-4.** Synthesize programs using inline assembly statements in C
- **CO-5.** Analyze, test and validate developed assembly programs
- **CO-6.** Document work done and prepare a laboratory report

Course Outcomes (COs)

Course Title & Code: Computer Networks Laboratory (CSL301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Relate the algorithms used by DLL and Network layers to their use in higher layer protocols
- **CO-2.** Express client-server applications as a set of appropriate function calls, as well as algorithms and/or flowcharts
- **CO-3.** Apply the Linux sockets API in the development of client-server-based computer networks
- **CO-4.** Choose between different types of servers and appropriate transport layer protocols
- **CO-5.** Design and implement applications using appropriate algorithms at PHY, DLL and Network Layers along with client-server interactions and create a laboratory report documenting the complete effort.

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Course Outcomes (COs)

Course Title & Code: Database Systems Laboratory (CSL302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the components of database systems
- **CO-2.** Explain the principles of database design and implementation
- **CO-3.** Design a database system for a given application
- **CO-4.** Implement a database using DBMS and interface it with an application
- **CO-5.** Test and validate the developed database system
- **CO-6.** Create a laboratory report documenting the work

Course Outcomes (COs)

Course Title & Code: Graph Theory and Optimization (CSC305A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the concepts, theories and techniques of graph theory and discrete optimization
- **CO-2.** Explain the principles of graph theory, discrete optimization and their applications in Computer Science and Engineering
- **CO-3.** Identify and apply appropriate approach from graph theory and discrete optimisation to formulate a given problem
- **CO-4.** Design graph theory and discrete optimisation based algorithms to solve problems in Computer Science and Engineering
- **CO-5.** Synthesize efficient algorithms for problems in Computer Science and Engineering using graph structures and discrete optimisation methods
- **CO-6.** Evaluate the utility of discrete optimisation and graph structures for modelling and analysis of computing systems

Course Outcomes (COs)

Course Title & Code: Computer Vision (CSC309A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss fundamentals of Digital Images with Image Formation and processing
- **CO-2.** To Discuss Image processing Techniques
- **CO-3.** Analyze and apply Image processing algorithms to solve recent computer vision problems.
- **CO-4.** Gather a basic understanding about the geo-metric relationships between 2D images world.
- **CO-5.** Apply classification, clustering algorithms for a given computer vision application
- **CO-6.** Implement machine learning algorithms for computer vision applications

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Course Outcomes (COs)

Course Title & Code: Natural Language Processing (CSC310A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the fundamental mathematical models and algorithms for NLP.
- **CO-2.** Explain major natural language processing challenges in various domains.
- **CO-3.** Discuss statistical language models and machine learning algorithms to extract information from various text data.
- **CO-4.** Apply mathematical models and algorithms in the design and implementation for NLP.
- **CO-5.** Recommend natural language processing tools currently available for unstructured text processing.
- **CO-6.** Implement methods for syntax and semantic analysis in NLP.

Course Outcomes (COs)

Course Title & Code: Deep Learning and Applications (CSC311A)

After the successful completion of this course, the student will be able to:

- **CO-1.** To discuss traditional machine learning techniques that have had an influence on deep learning algorithms; to discuss foundations of neural networks.
- **CO-2.** To use Tensor Flow to implement neural networks; to manage problems that arise as networks are made deeper.
- **CO-3.** To discuss convolution operator and the building blocks for convolutional network architectures; to build neural networks that analyze complex images, detect and locate objects.
- **CO-4.** To discuss and apply practical design process for deep learning applications; to perform sequence analysis to examine language.
- **CO-5.** To apply deep reinforcement learning techniques.
- **CO-6.** To apply deep Generative model techniques.

Course Outcomes (COs)

Course Title & Code: Pattern Recognition (CSC312A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss concepts of pattern recognition and machine learning
- **CO-2.** Discuss the concept of Bayesian inference and decision theory.
- **CO-3.** Discuss the concepts of dimensionality reduction, principal component analysis and linear discriminant analysis.
- **CO-4.** Build classifiers for various pattern recognition applications.
- **CO-5.** Apply pattern recognition and machine learning algorithms for image processing applications.
- **CO-6.** Apply pattern recognition algorithms to solve problems and to mathematically model simple applications from engineering.

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Course Outcomes (COs)

Course Title & Code: Seminar **(CSS301A)**

After the successful completion of this course, the student will be able to:

- **CO-1.** Demonstrate the understanding of Selection of relevant Topics for Presentations
- **CO-2.** Get exposed to the Collection of Material, Reading and Comprehension
- **CO-3.** Learn to make a Report in a given format and Prepare Presentation on the Report
- **CO-4.** Get into Facing an Audience while presenting their Work and managing a Q&A Session

Course Outcomes (COs)

Course Title & Code: Natural Language Processing Laboratory (AIL302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Identify fundamental mathematical models and algorithms for NLP.
- **CO-2.** Illustrate the working of syntactic and semantic analysis in NLP
- **CO-3.** Develop algorithms and programs for Rule-based Natural Language Processing
- **CO-4.** Design and develop solution for Statistical Natural Language Processing
- **CO-5.** Evaluate the empirical performance of implemented Vector Semantics and embedding algorithms
- **CO-6.** Document work done and prepare a laboratory report.

Course Outcomes (COs)

Course Title & Code: Deep Learning and Applications Laboratory (AIL303A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Getting to know fundamentals of Tensor Flow
- **CO-2.** Illustrate the working of Gradient Descent with Tensor Flow
- **CO-3.** Develop algorithms and programs to solve a given problem using MLP
- **CO-4.** Design and develop Convolutional Neural Networks.
- **CO-5.** Design and develop Natural Language Processing using LSTM.
- **CO-6.** Design and develop Dimensionality reduction techniques.
- **CO-7.** Document work done and prepare a laboratory report

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Course Outcomes (COs)

Course Title & Code: Project Work-1 (CSP401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Recognize the need for developing a new or improving an existing engineering product/system through an organized survey of literature and requirement analysis

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CO-2. Define engineering design specifications based on
CO-3. Design, model, synthesize, analyze the solution to meet the design specifications
CO-4. Evaluate the performance of the modelled system and justify its performance
CO-5. Demonstrate the system working in a virtual environment and make a presentation
CO-6. Write a project report

Course Outcomes (COs)

Course Title & Code: Internship (CSI401A)

After the successful completion of this course, the student will be able to:

CO-1. Understanding the Process Stock of the Industry
CO-2. Gain experience of the Process Stock by working on an ongoing Project in the Industry
CO-3. Learn to manifest the work done in the form of a Report in a given format.
CO-4. Get experienced on Presenting the Work Done and Facing an Audience while presenting their Work.

Course Outcomes (COs)

Course Title & Code: Project Work-2 (CSC402A)

After the successful completion of this course, the student will be able to:

CO-1. Recognize the need for developing a new or improving an existing engineering product/system through an organized survey of literature and requirement analysis
CO-2. Define engineering design specifications based on the software requirements specification
CO-3. Design, model, synthesize, analyze the solution to meet the design specifications
CO-4. Evaluate the performance of the modelled system and justify its performance
CO-5. Demonstrate the system working in a virtual environment and make a presentation
CO-6. Write a project report

Course Outcomes (COs)

Course Title & Code: Information Security and Protection (CSC306A)

After the successful completion of this course, the student will be able to:

CO-1. Describe elements and components of information security and protection
CO-2. Describe security attacks and defense mechanisms
CO-3. Explain the requirements, principles and models of security policies
CO-4. Analyze the security properties of a given model
CO-5. Analyze a given scenario, application or system and recommend appropriate security policies and mechanisms
CO-6. Develop security policies and mechanisms for a given scenario, application or system

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Course Outcomes (COs)

Course Title & Code: Internet of Things (ISE404A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the need and importance of IoT in present day communication networks
- **CO-2.** Explain the architectural overview and reference architecture of IoT
- **CO-3.** Describe popular IoT protocols and standards for different IoT applications
- **CO-4.** Recommend appropriate IoT devices and protocols for given applications
- **CO-5.** Integrate sensors, actuators, gateways, displays and cloud for IoT applications
- **CO-6.** Develop IoT applications for industry specific requirements and analyze the obtained data

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence and Healthcare (AIE403A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the role and assess the benefits and risks of Artificial Intelligence in Healthcare
- **CO-2.** Describe data mining in clinical data analysis
- **CO-3.** Discuss the role of deep learning and machine learning for diverse types of healthcare data
- **CO-4.** Discuss and apply pattern recognition in medical image analysis for disease diagnosis
- **CO-5.** Apply Natural Language Processing methods to extract information from Electronic Health Records

Course Outcomes (COs)

Course Title & Code: Quantum Computing (MCC309A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the quantum mechanical, computational and information theoretical concepts underlying quantum computing
- **CO-2.** Describe the concepts of quantum computation, quantum circuits and quantum information theory
- **CO-3.** Explain the architectural and programming principles of quantum computing
- **CO-4.** Explain the principles of quantum algorithms and their applications
- **CO-5.** Analyse simple quantum computing circuits and algorithms
- **CO-6.** Design quantum algorithms for a given application

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Course Outcomes (COs)

Course Title & Code: Computational Intelligence (CSE408A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss the terms and concepts related to fuzzy systems, evolutionary computation, swarm

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intelligence and artificial immune systems

- **CO-2.** Analyze whether a specific engineering problem can be solved using a CI approach
- **CO-3.** Compare and contrast different CI techniques used to achieve particular functionalities
- **CO-4.** Recommend the most suitable CI technique to address a specific engineering problem
- **CO-5.** Specify, implement, customize and evaluate typical CI algorithms to solve a practical problem
- **CO-6.** Develop variants and hybrids of the typical CI algorithms

Course Outcomes (COs)

Course Title & Code: Data Engineering (AIE301A)

After the successful completion of this course, the student will be able to:

- **CO-1.** To choose appropriate data processing techniques, frameworks and tools for a Big Data
- **CO-2.** To develop models for structured data using Big Data models
- **CO-3.** To design a Big Data processing application using modern data processing techniques, frameworks and tools
- **CO-4.** To synthesize a data processing application for Big Data
- **CO-5.** To analyze Big Data using a data processing workflow and evaluate alternative solutions to a Big Data processing problem

Course Outcomes (COs)

Course Title & Code: Time Series Analysis (AIE402A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Explain time series data with an appropriate statistical framework and examples
- **CO-2.** Perform appropriate preprocessing and carryout exploratory data analysis on time series data
- **CO-3.** Apply appropriate filters, smoothing techniques on time series data and interpret the results
- **CO-4.** Discuss appropriate statistical modelling techniques for forecasting time series data
- **CO-5.** Apply and forecast time series data using stationary, non-stationary, multivariate time series models
- **CO-6.** Use R to model, forecasts and interpret the results for time series data

Course Outcomes (COs)

Course Title & Code: Graph Analytics for Big data (AIE404A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe fundamental mathematical models for graphical data analysis
- **CO-2.** Explain Graph Analytics Frameworks for big data
- **CO-3.** Discuss graphical data analysis algorithms for empirical data analysis
- **CO-4.** Apply statistical software for graphical big data analysis
- **CO-5.** Recommend graphical data analysis algorithms for modelling given Big Data
- **CO-6.** Implement graph algorithms using the techniques of high-performance computing

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Course Outcomes (COs)

Course Title & Code: Principles and Practices of Cryptography (CSE302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe techniques used for confidentiality and integrity in computing systems
- **CO-2.** Discuss the importance, working and application of techniques to ensure confidentiality and integrity
- **CO-3.** Compare and choose appropriate cryptographic techniques for a given scenario.
- **CO-4.** Identify confidentiality and integrity issues in code review and suggest appropriate countermeasures
- **CO-5.** Design secure applications using appropriate cryptographic techniques
- **CO-6.** Develop security subsystems using appropriate cryptographic techniques

Course Outcomes (COs)

Course Title & Code: Block chain Technologies (ISE405A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Discuss about Blockchain technologies and evolution
- **CO-2.** Explain smart contracts
- **CO-3.** Discuss Components and Structure of Blockchain
- **CO-4.** Compare and contrast decentralized and distributed systems
- **CO-5.** Explain security principles behind blockchain
- **CO-6.** Discuss achieving consensus in the design of blockchain applications

Course Outcomes (COs)

Course Title & Code: Advanced Mathematics (MTE302A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Define and explain Legendre and Bessel differential equation, curvature, torsion, geodesics, manifolds and tensors
- **CO-2.** State the results and theorems and solve simple problems in Legendre differential equations, Bessel differential equation, theory of curves and surfaces
- **CO-3.** Apply differential geometry techniques to compute Gaussian curvature, mean curvature, principal curvature and torsion
- **CO-4.** Solve complex engineering problems associated with Bessel differential equation, theory of curves and surfaces, orthogonal curvilinear coordinates and spherical curvilinear system
- **CO-5.** Analyze real world problems associated with Bessel differential equation and curvature of space curves

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Course Outcomes (COs)

Course Title & Code: Optimization Techniques (MTE401A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe fundamentals of convex and concave functions, linear programming and constraint nonlinear optimization
- **CO-2.** State and explain important classical techniques and numerical methods of constraint optimization
- **CO-3.** Demonstrate the skill to analyze a problem by choosing effective optimization tools
- **CO-4.** Apply optimization techniques to model real world problems
- **CO-5.** Solve complex problems associated with linear programming and constraint optimization of function of several variables

Course Outcomes (COs)

Course Title & Code: Advanced Numerical Methods (MTE403A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Illustrate various methods of numerical computation of Eigen values
- **CO-2.** Illustrate various methods to solve partial differential equations
- **CO-3.** Apply numerical methods to solve partial differential equations using MATLAB
- **CO-4.** Analyze real world problems associated with computing eigenvalues and partial differential equations
- **CO-5.** Solve complex problems arising in real world using finite volume and finite elements methods to solve partial differential equations

Course Outcomes (COs)

Course Title & Code: Data Mining (CSE421A)

After the successful completion of this course, the student will be able to:

- **CO-1.** Describe the conceptual framework of classification and clustering
- **CO-2.** Explain the principles of supervised and unsupervised learning algorithms, training and test data
- **CO-3.** Apply machine learning techniques to solve problems of practical importance
- **CO-4.** Analyse the given data using classification and clustering algorithms
- **CO-5.** Synthesise and solve data mining problems of practical importance using theoretical analysis and software tools

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