Teerthanker Mahaveer University
College of Computing Sciences & IT

B.Tech. (Computer Sciences and Engineering)
Artificial Intelligence, Machine Learning & Deep Learning

Programme Outcome

PO-1	**:**	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO-2	**:**	Problem analysis& Solving: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**:**	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-4	**:**	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	**:**	Modern tool usage: 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	**:**	Social Interaction & effective citizenship: 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	**:**	Environment and sustainability: 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	**:**	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	**:**	Attitude (Individual and team work): Function effectively as an individual, and as member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**:**	Communication: 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 give and receive clean instructions.
PO-11	**:**	Project management and finance: 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, to manage projects and in multidisciplinary environments.
PO-12	**:**	Life-long learning: 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.

PO-13	**:**	Entrepreneurship: An Entrepreneurship cut across every sector of human life including the field of engineering, engineering entrepreneurship is the process of harnessing the business opportunities in engineering and turning it into profitable commercially viable innovation.
PO-14	**:**	Interpersonal skills: Interpersonal skills involve the ability to communicate and build relationships with others. Effective interpersonal skills can help the students during the job interview process and can have a positive impact on your career advancement.
PO-15	**:**	Technology savvy/usage: Being technology savvy is essentially one's skill to be smart with technology. This skill reaches far beyond "understanding" the concepts of how technology works and encompasses the "utilization" of such modern technology for the purpose of enhancing productivity and efficiency.

Programme Specific Outcome

PSO-1	**:**	Understanding the knowledge of basic sciences, humanities and technical management courses of the program. Able to solve engineering problems of real time projects in the field of computer science and information technology.
PSO-2	**:**	Understanding the phases of software project development life cycle and various roles.
PSO-3	**:**	Applying hardware and software skills pertinent to practices in the field of computer science and information technology while acquiring mathematical foundations, algorithmic principles along with proper judgment through projects and industrial interactions.
PSO-4	**:**	Analyzing the various storage structures of data on different platforms along with security issues.
PSO-5	**:**	Analyzing large data samples and discover knowledge to provide solution to engineering problem.
PSO-6	**:**	Developing skills of practical competency with emerging technologies, programming languages and open source platforms.
PSO-7	**:**	Developing effective artificial intelligence based solutions for real world problem.

Course Outcomes

EAS116	**CO-1**	Understanding the concepts of eigenvalues and eigenvectors, Optimization & derivatives of functions of several variables, partial and total differentiation, implicit functions
	CO-2	Understanding the concepts of curl and divergence of vector field.
	CO-3	Understanding of Green's theorem, Gauss Theorem, and Stokes theorem.
	CO-4	Applying the concept of Leibnitz's theorem for successive derivatives.
	CO-5	Analyzing the intangibility of a differential equation to find the optimal solution of first order first degree equations.
	CO-6	Evaluating the double integration and triple integration using Cartesian, polar co-ordinates and the concept of Jacobian of transformation.
EAS112	**CO-1**	Understanding the basic concepts of interference, diffraction and polarisation.
	CO-2	Understanding the concept of bonding in solids and semiconductors.
	CO-3	Understanding the special theory of relativity.

	CO-4	Applying special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence etc.
	CO-5	Applying the concepts of polarized light by the Brewster's and Malus Law
EAS113	**CO-1**	Understanding the concept of softening & purification of water.
	CO-2	Understanding calorific value& combustion, analysis of coal, Physical & Chemical properties of hydrocarbons & quality improvements.
	CO-3	Understanding the concept of lubrication, Properties of Refractory & Manufacturing of cements.
	CO-4	Applying the concepts of the mechanism of polymerization reactions, Natural and synthetic rubber& vulcanization.
	CO-5	Applying the concepts of spectroscopic & chromatographic techniques
EEE117	**CO-1**	Understanding the basics of Network, AC Waveform and its characteristics.
	CO-2	Understanding the basic concept of Measuring Instruments, Transformers & three phase Power systems.
	CO-3	Understanding the basic concepts of Transformer.
	CO-4	Understanding the basic concept of power measurement using two wattmeter methods.
	CO-5	Applying the concept of Kirchhoff's laws and Network Theorems to analyze complex electrical circuits.
EEC111	**CO-1**	Understanding the concepts of electronic components like diode, BJT & FET.
	CO-2	Understanding the applications of pn junction diode as clipper, clamper, rectifier & regulator whereas BJT & FET as amplifiers
	CO-3	Understanding the functions and applications of operational amplifier-based circuits such as differentiator, integrator, and inverting, non-inverting, summing & differential amplifier.
	CO-4	Understanding the concepts of number system, Boolean algebra and logic gates
	CO-5	Applying the knowledge of series, parallel and electromagnetic circuits.
TMU101	**CO-1**	Understanding environmental problems arising due to constructional and developmental activities.
	CO-2	Understanding the natural resources and suitable methods for conservation of resources for sustainable development.
	CO-3	Understanding the importance of ecosystem and biodiversity and its conservation for maintaining ecological balance.
	CO-4	Understanding the types and adverse effects of various environmental pollutants and their abatement devices.
	CO-5	Understanding Greenhouse effect, various Environmental laws, impact of human population explosion, environment protection movements, different disasters and their management.
TMUGE101	**CO-1**	Remembering and understanding of the basic of English grammar and vocabulary.
	CO-2	Understanding of the basic Communication process.
	CO-3	Applying correct vocabulary and tenses in sentences construction.
	CO-4	Analyzing communication needs and developing communication strategies using both verbal & non-verbal method.

	CO-5	Drafting applications in correct format for common issues.
	CO-6	Developing self-confidence.
EAS162	**CO-1**	Understanding of the operation of various model of optical devices.
	CO-2	Understanding types of Semiconductors using Hall experiments.
	CO-3	Applying the concept of interference, polarization & dispersion in optical devices through Newton's ring, Laser, polarimeter & spectrometer.
	CO-4	Applying the concept of resonance to determine the AC frequency using sonometer & Melde's apparatus.
	CO-5	Applying the concept of resolving & dispersive power by a prism.
EAS163	**CO-1**	Understanding the concepts of Hardness of water.
	CO-2	Analyzing & estimating of various parameters of water
	CO-3	Analyzing of Calorific value of Solid fuel by Bomb calorimeter & Liquid Fuels by Junkers Gas Calorimeter.
	CO-4	Analyzing of open & closed Flash point of oil by Cleveland & Pensky's Martens apparatus.
	CO-5	Analyzing of viscosity of lubricating oil using Redwood Viscometer.
EEE161	**CO-1**	Understanding the concepts of Kirchoff & Voltage law.
	CO-2	Understanding the concepts of Thevenin & Norton theorem.
	CO-3	Analyzing the energy by a single-phase energy meter.
	CO-4	Analyzing the losses and efficiency of Transformer on different load conditions.
	CO-5	Analyzing the electrical circuits using electrical and electronics components on bread board.
EEC161	**CO-1**	Understanding the implementation of diode-based circuits.
	CO-2	Understanding the implementation of Operational amplifier-based circuits.
	CO-3	Analyzing the characteristics of pn junction diode & BJT.
	CO-4	Analyzing the different parameters for characterizing different circuits like rectifiers, regulators using diodes and BJTs.
	CO-5	Analyzing the truth tables through the different type's adders.
EME161	**CO-1**	Understanding the concepts of Engineering Drawing.
	CO-2	Understanding how to draw and represent the shape, size & specifications of physical objects.
	CO-3	Applying the principles of projection and sectioning.
	CO-4	Applying the concepts of development of the lateral surface of a given object.
	CO-5	Creating isometric projection of the given orthographic projection.
EME162	**CO-1**	Understanding the concepts to prepare simple wooden joints using wood working tools.
	CO-2	Applying the techniques to produce fitting jobs of specified dimensions.
	CO-3	Applying the concepts to prepare simple lap, butt, T and corner joints using arc welding equipment.
	CO-4	Applying the concepts of black smithy and lathe machine to produce different jobs.
	CO-5	Creating core and moulds for casting.
EAS211	**CO-1**	Understanding the concepts of the wave, diffusion and Laplace equations & Fourier series.

	CO-2	Understanding the methods of separation of variables
	CO-3	Understanding the concepts of Fourier series' representation of single variable function.
	CO-4	Applying Laplace transform to determine the complete solutions of linear ODE
	CO-5	Applying the method of variations of parameters to find solution of equations with variable coefficients.
EAS212	**CO-1**	Understanding the basic concepts of interference, diffraction and polarisation.
	CO-2	Understanding the concept of bonding in solids and semiconductors.
	CO-3	Understanding the special theory of relativity.
	CO-4	Applying special theory of relativity to explain the phenomenon of length contraction, time dilation, mass-energy equivalence etc.
	CO-5	Applying the concepts of polarized light by the Brewster's and Malus Law
EAS213	**CO-1**	Understanding the concept of softening & purification of water.
	CO-2	Understanding calorific value& combustion, analysis of coal, Physical & Chemical properties of hydrocarbons & quality improvements.
	CO-3	Understanding the concept of lubrication, Properties of Refractory & Manufacturing of cements.
	CO-4	Applying the concepts of the mechanism of polymerization reactions, Natural and synthetic rubber& vulcanization.
	CO-5	Applying the concepts of spectroscopic & chromatographic techniques.
EEE217	**CO-1**	Understanding the basics of Network, AC Waveform and its characteristics.
	CO-2	Understanding the basic concept of Measuring Instruments, Transformers & three phase Power systems.
	CO-3	Understanding the basic concepts of Transformer.
	CO-4	Understanding the basic concept of power measurement using two wattmeter methods.
	CO-5	Applying the concept of Kirchhoff's laws and Network Theorems to analyze complex electrical circuits
EEC211	**CO-1**	Understanding the concepts of electronic components like diode, BJT & FET.
	CO-2	Understanding the applications of pn junction diode as clipper, clamper, rectifier & regulator whereas BJT & FET as amplifiers
	CO-3	Understanding the functions and applications of operational amplifier-based circuits such as differentiator, integrator, and inverting, non-inverting, summing & differential amplifier.
	CO-4	Understanding the concepts of number system, Boolean algebra and logic gates.
	CO-5	Applying the knowledge of series, parallel and electromagnetic circuits.
ECS201	**CO-1**	Understanding the concept of various components of computer system
	CO-2	Understanding the basic programming Language constructs.
	CO-3	Analyzing basic mathematical problem and their solutions through programming
	CO-4	Applying knowledge to prepare programming solutions for distinct problems.

	CO-5	Applying knowledge to prepare scalable solutions through functions.
TMUGE201	**CO-1**	Remembering & understanding the basics of English Grammar and Vocabulary
	CO-2	Understanding the basics of Listening, Speaking & Writing Skills, Understanding principles of letter drafting and various types of formats.
	CO-3	Applying correct vocabulary and grammar in sentence construction while writing and delivering presentations
	CO-4	Analyzing different types of listening, role of Audience & Locale in presentation
	CO-6	Creating Official Letters, E-Mail & Paragraphs in correct format.
EAS262	**CO-1**	Understanding of the operation of various models of optical devices.
	CO-2	Understanding types of Semiconductors using Hall experiments.
	CO-3	Applying the concept of interference, polarization & dispersion in optical devices through Newton's ring, Laser, polarimeter & spectrometer.
	CO-4	Applying the concept of resonance to determine the AC frequency using sonometer & Melde's apparatus.
	CO-5	Applying the concept of resolving & dispersive power by a prism.
EAS263	**CO-1**	Understanding the concepts of Hardness of water.
	CO-2	Analyzing & estimating of various parameters of water.
	CO-3	Analyzing of Calorific value of Solid fuel by Bomb calorimeter & Liquid Fuels by Junkers Gas Calorimeter.
	CO-4	Analyzing of open & closed Flash point of oil by Cleveland & Pensky's Martens apparatus.
	CO-5	Analyzing of viscosity of lubricating oil using Redwood Viscometer.
EEE261	**CO-1**	Understanding the concepts of Kirchoff & Voltage law.
	CO-2	Understanding the concepts of Thevenin & Norton theorem.
	CO-3	Analyzing the energy by a single-phase energy meter.
	CO-4	Analyzing the losses and efficiency of Transformer on different load conditions.
	CO-5	Analyzing the electrical circuits using electrical and electronics components on bread board.
EEC261	**CO-1**	Understanding the implementation of diode-based circuits.
	CO-2	Understanding the implementation of Operational amplifier-based circuits.
	CO-3	Analyzing the characteristics of pn junction diode & BJT.
	CO-4	Analyzing the different parameters for characterizing different circuits like rectifiers, regulators using diodes and BJTs.
	CO-5	Analyzing the truth tables through the different type's adders.
ECS251	**CO-1**	Analyzing basic mathematical problem and their solutions through programming
	CO-2	Applying knowledge to prepare programming solutions for specific problems.
	CO-3	Applying knowledge to prepare scalable solutions through function
	CO-4	Applying the concepts of programming solutions for distinct problems
	CO-5	Applying the concepts of scalable solutions through function
EME261	**CO-1**	Understanding the concepts of Engineering Drawing.
	CO-2	Understanding how to draw and represent the shape, size &

		specifications of physical objects.
	CO-3	Applying the principles of projection and sectioning.
	CO-4	Applying the concepts of development of the lateral surface of a given object.
	CO-5	Creating isometric projection of the given orthographic projection.
EME262	**CO-1**	Understanding the concepts to prepare simple wooden joints using wood working tools.
	CO-2	Applying the techniques to produce fitting jobs of specified dimensions.
	CO-3	Applying the concepts to prepare simple lap, butt, T and corner joints using arc welding equipment.
	CO-4	Applying the concepts of black smithy and lathe machine to produce different jobs.
	CO-5	Creating core and moulds for casting.
ECS305	**CO-1**	Understanding of different data structures and their usage.
	CO-2	Applying the understanding to solve basic operations on data structures.
	CO-3	Analyzing various approaches to solve different problems using data structures
	CO-4	Analyzing various methods and the best solution as per running time of basic problems of programming.
	CO-5	Developing programming skills to solve problems with various storage structures
ESC306	**CO-1**	Understanding the basics of data base systems, structure and architecture along with data models and its type
	CO-2	Understanding different transaction processing concepts and different types of serialization techniques.
	CO-3	Understanding different database recovery like shadow paging, deferred/immediate updates and Concurrency control techniques.
	CO-4	Applying integrity and constraints using SQL and PL/SQL.
	CO-5	Analyzing the anomalies of database and removal of these anomalies using different normalization techniques.
EAS301	**CO-1**	Understanding the concepts of singularities, zeroes and poles, functions , relations, propositions, truth tables, logical equivalence and implications, converse, inverse, bi-conditional statements, negation of compound statements, tautologies and contradiction, arguments, fallacies, quantifiers.
	CO-2	Applying the concept of power series, Taylor's and Laurent‘s series, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Residue theorem
	CO-3	Applying the core mathematics concept to solve the problems
	CO-4	Analyzing the method of least squares and curve fitting of straight line and parabola, solution of cubic and bi-quadratic equations, correlation and regression, Binomial distribution, Poisson distribution and Normal distribution
	CO-5	Evaluating the real integral of the type 2 0 f cos ,sin d , Line integral in the complex plane
EECS302	**CO-1**	Understanding the basics of Number system, Boolean algebra and its applications in digital electronics.

	CO-2	Understanding different combinational and sequential circuits in digital electronics.
	CO-3	Understanding the organization of computer system and its components, memory hierarchy, I/O mechanism
	CO-4	Applying the concepts to design various combinational and sequential circuits.
	CO-5	Analyzing the efficiency of various gates and flip-flops based upon their functionality.
EAI305	**CO-1**	Understanding of different control statements of python.
	CO-2	Understanding various data storage structure used in python like dictionary, List and Series.
	CO-3	Understanding the concept of network programming usage with python.
	CO-4	Applying various packages used in data science like numpy, pandas and scikit.
	CO-5	Analyzing the concept of exception handling concept.
	CO-6	Developing problem solving skills using python constructs
TMUGE301	**CO-1**	Remembering and understanding the English grammar and vocabulary.
	CO-2	Understanding the art of public speaking and strategies of reading comprehension.
	CO-3	Applying correct vocabulary and sentence construction during public speaking or professional writing.
	CO-4	Analyzing different types of sentences like simple, compound and complex. Drafting notice, agenda and minutes of the meeting.
	CO-5	Developing speaking skills during common conversation and power point presentation.
ECS355	**CO-1**	Applying the concept of different data types and their usage using C++ Programs
	CO-2	Applying the concept of recursion for problem solving using tail and binary recursion.
	CO-3	Applying the programming constructs and their usage for problem solving.
	CO-4	Applying the understanding to solve basic operations searching, sorting, insertion, deletion on data structures.
	CO-5	Developing programming skills to solve problems with various storage structures like stack, queue, linked list and tree.
ECS356	**CO-1**	Understanding the concepts of DML operation to database table to complete different queries on database.
	CO-2	Applying the concepts of different DDL operations
	CO-3	Applying the concepts of DCL operations like grant and revoke for administration purpose on a table
	CO-4	Applying the concepts of PL/SQL for creating different triggers to develop event driven action in database
	CO-5	Analyzing the concepts of PL/SQL for creating functions and procedure to apply DML on tables
EAI353	**CO-1**	Understanding the concepts of different collections - list, tuple, dictionaries and dataframes.
	CO-2	Applying the concepts to built functions in Python

	CO-3	Applying the concept of database connectivity with python to perform some operations in database
	CO-4	Applying the programming construct to perform various matrix operations.
	CO-5	Analyzing the concepts of packages in python and create own packages.
TMUGA-301	**CO-1**	Solving complex problems using Criss cross method, base method and square techniques.
	CO-2	Applying the arithmetical concepts of Average, Mixture and Allegation.
	CO-3	Evaluating the different possibilities of various reasoning based problems in series, Blood relationand Direction.
	CO-4	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.
ECS401	**CO-1**	Understanding the fundamentals of Computational theory and basic terminology used.
	CO-2	Understanding basics of various machines used for computations like FSM, PDA, TM.
	CO-3	Understanding the grammar, language, formation of regular expression in FA, minimization of FA and CFG.
	CO-4	Applying the concepts to design various machines like FSM, PDA etc
	CO-5	Analyzing the efficiency of various machines based upon their functionality and limitations
EAI402	**CO-1**	Understanding the concepts of network fundamentals and terminology.
	CO-2	Understanding the principles of LAN design such as topology and configuration
	CO-3	Understanding various network industry standards such as: the OSI model, Routing Protocols, Address Resolution and Reverse Address Resolution Protocols.
	CO-4	Analyzing different type of network interfaces and their usage.
	CO-5	Evaluating the configurations of IP Addresses and Subnetting, MAC Addressing
EAI403	**CO-1**	Understanding the phases of software development life cycle.
	CO-2	Applying Agile Methodology of software testing and constructing software testing plan.
	CO-3	Analyzing various methods of Software development cost estimation.
	CO-4	Analyzing software requirement specification document and its usability.
	CO-5	Analyzing software Maintenance and quality assurance standard.
EAI404	**CO-1**	Understanding the Artificial Intelligence, application areas and importance of Turing test in identifying AI applications
	CO-2	Understanding the Artificial Intelligence, application areas and importance of Turing test in identifying AI applications
	CO-3	Understanding the Artificial Intelligence, application areas and importance of Turing test in identifying AI applications
	CO-4	Understanding the symbolic logic in AI and able to use predicates & High order logic, effectively for representation of scenario and Understanding the different knowledge representation mechanisms and effectively use them for representing knowledge
	CO-5	Evaluating the performance of various search algorithms and heuristic

		algorithms in solving complex problems
ECS407	**CO-1**	Understanding the object-oriented approach of programming, basic building blocks of java programming, java development environment, datatypes, class, methods, and various predefine packages.
	CO-2	Understanding the various predefine classes, interfaces, which deals with networking, understanding the basic approach of graphical user interface design using Abstract window toolkit and Applet.
	CO-3	Understanding the basic concept of Event handling, Applying the concept of thread and multithreading.
	CO-4	Understanding the Database connectivity using java, along with the classes and methods of java.sql package and creating basic programs using this package.
	CO-5	Applying the graphical user interface design concept using Swing.
	CO-6	Analyzing the predefine methods and interfaces of Swing package and creating basic user interface using swing.
ECS406	**CO-1**	. Understanding the concepts and states of process, also evaluating the use of various scheduling algorithms and finding the suitability for their usage.
	CO-2	Understanding and Analyzing various issues in Inter Process Communication (IPC) and the role of OS in IPC, also understanding the various characteristics of deadlock and applying the learnt concepts and algorithm to avoid and recover from the deadlock.
	CO-3	Understanding the concepts and implementation of various Memory management policies and usage of the virtual memory.
	CO-4	Applying the Basics of operating system along with the types and main functionalities of the operating system.
	CO-5	Applying the file management policies and disk structure along with scheduling algorithm for applying it to solve the disk scheduling problems
TMUGE401	**CO-1**	Remembering and understanding the English grammar and vocabulary.
	CO-2	Understanding the essentials of effective listening and speaking.
	CO-3	Understanding the corporate expectations and professional ethics
	CO-4	Applying correct vocabulary and sentence construction during professional writing or job interviews.
	CO-5	Analyzing different types of interviews. Drafting resume, C.V. or cover letter
ECS456	**CO-1**	Applying knowledge to solve real world problems based on object-oriented principles.
	CO-2	Applying the basic approach of graphical user interface design using Abstract window toolkit, Applet and swing packages, create some application that are based upon some real world scenario
	CO-3	Analyzing the concept of database handling and creating application that are able to communicate with various database
	CO-4	Analyzing the Client server architecture, Understanding the Remote method invocation architecture and creating basic application using Remote method invocation.
	CO-5	Analyzing the web architecture for creating applications using servlets and java server pages.

EAI452	**CO-1**	Understanding the role of PROLOG for implementation of solutions of AI problem
	CO-2	Understanding the architecture and evaluation scheme of PROLOG
	CO-3	Applying the PROLOG for solving trivial problems
	CO-4	Analyzing the solutions for Water Jug problem, Eight Puzzle problem, Monkey Banana problem using PROLOG
	CO-5	Analyzing the various knowledge representation structures
EAI453	**CO-1**	Understanding the working of network simulation tool (Packet Tracer)
	CO-2	Understanding about basic network connectivity. Understand IOS used for networking devices
	CO-3	Understanding about ARP table. Analyzing some trouble shooting commands
	CO-4	Applying the knowledge to Configure the initial switch and router setting, Understand TCP/IP and OSI models
	CO-5	Analyzing MAC and IP addresses, Learn about TCP and UDP communications.
TMUGA-401	**CO-1**	Applying the arithmetical concepts in Ratio Proportion Variation.
	CO-2	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work, Time Speed and Distance.
	CO-3	Identifying different possibilities of reasoning based problems of Syllogismsand Venn diagram.
	CO-4	Examining the optimized approach to solve logs and Surds
EAI501	**CO-1**	Understanding principles of artificial neural network and models of artificial neuron
	CO-2	Understanding the concept of supervised, un-supervised, and semi-supervised learning algorithms
	CO-3	Understanding the concept of back-propagation algorithm and backpropagation algorithm based neural net
	CO-4	Understanding the architecture and applications of associative memory network, auto-associative memory network, and hetero-associative memory network
	CO-5	Understanding the architecture and applications of adaptive resonance theory and self-organizing map
ECS503	**CO-1**	Understanding the basic concept of algorithm design, algorithm efficiency, run time complexity computation, divide and conquer concept of algorithm design, binary search algorithm analysis, divide and conquer approach analysis.
	CO-2	Understanding concept of greedy method in problem solving, exact optimization solution for minimum cost spanning tree, approximate solution for knapsack problem, single shortest path computation.
	CO-3	Applying concept of dynamic programming in problem solving, dynamic programming vs divide and conquer, shortest path computation application, matrix multiplication application, traveling salesman problem application, longest common subsequence application.
	CO-4	Applying basic concept of branch and bound method, LC searching bounding, FIFO branch and bound, 0/1 knapsack problem, travelling salesman problem, complexity measures, polynomial vs non-polynomial

		time complexity, NP-hard and NP-complete problem.
	CO-5	Analyzing concept of graph problem to get solution of depth first search method, breadth first search method, back tracking, 8-queen problem, knapsack problem
EAI503	**CO-1**	Understanding basic components of a Web Technology (Design And Architecture Using .NET)
	CO-2	Understanding various categories of programs, Web, Window and Console Application. Organize and work with many projects
	CO-3	Applying skills and concepts to built small real life applications using Web Technology (Design And Architecture Using .NET) standards.
	CO-4	Analyzing the usage of the Web Technology (Design And Architecture Using .NET) programs to create professional, academic, business and many software projects
	CO-5	Developing personal, academic and business documents by following the current professional and/or industry standards
EAI504	**CO-1**	Understanding basic concept of machine learning, advantages and disadvantages, applications, learning algorithms: supervised learning, unsupervised learning, semi- supervised learning, reinforcement learning, decision trees, Hunt's algorithm for learning a decision tree
	CO-2	Understanding concept of KNNs,SVMsand Naïve Bayes algorithms in text classification, decision boundary of KNN, feature selection using KNN, linear classifiers.
	CO-3	Understanding concept of ANN and regression, perceptron algorithm, decision boundary of single neuron, linear regression, logistic regression, and logistic regression for multi-class classification.
	CO-4	Applying concept of feature selection and feature extraction, filter based methods for feature selection, wrapper methods for features selection.
	CO-5	Applying concept of sequence labeling and clustering in classification, probabilistic sequence model, hidden markov model in classification, K-mean clustering, hierarchical clustering methods
EHM505	**CO-1**	Understanding the importance of value education in life and method of self-exploration.
	CO-2	Understanding ‗Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
	CO-3	Applying right understanding about relationship and physical facilities.
	CO-4	Analyzing harmony in myself, harmony in the family and society, harmony in the nature and existence
	CO-5	Evaluating human conduct on ethical basis.
ECS552	**CO-1**	Applying divide and conquer concept of algorithm in binary search, quick sorting and merge sorting
	CO-2	Applying concept of greedy method in exact optimization solution for minimum cost spanning tree, approximate solution for knapsack problem, single shortest path computation
	CO-3	Applying concept of dynamic programming in shortest path computation application, matrix multiplication application, traveling salesman problem application, longest common subsequence application.
	CO-4	Applying concept of graph in to find solution of depth first search

		method, breadth first search method, back tracking, 8-queen problem, and knapsack problem
	CO-5	Analyzing backtracking concept in connected components computation in graph
EAI552	**CO-1**	Understanding the basic constructs of HTML.
	CO-2	Understanding various categories of programs, Web, Window and Console Application. Organize and work with many projects
	CO-3	Analyzing the usage of the Web Technology (Design And Architecture Using .NET) programs to create professional, academic, business and many software projects.
	CO-4	Analyzing personal, academic and business documents by following the current professional and/or industry standards.
	CO-5	Applying skills and concepts to built small real life applications using Web Technology (Design And Architecture Using .NET) standards
EAI553	**CO-1**	Applying feature extraction algorithms on text data and image data
	CO-2	Applying feature selection algorithms on text data and image data.
	CO-3	Applying EM algorithm to cluster a set of data stored in a .CSV file.
	CO-4	Applying EM and K-mean algorithm on data and compare results of clustering
	CO-5	Applying Bayesian network on medical data in diagnosis of heart patients using heart disease data set and Applying Naïve Bayesian Classifier in document classification.
ECS559	**CO-1**	Understanding various resources and platform of online learning.
	CO-2	Understanding the credit utilities to be earn from online platform.
	CO-3	Understanding the current trends in the technology around the world.
	CO-4	Applying themselves in a competitive environment, weekly assignments and quiz
	CO-5	Developing Various latest AI models and technologies in real world to shape the career.
ECS599	**CO-1**	Understand research and development on latest technology.
	CO-2	Understanding of administrative functions and company culture
	CO-3	Applying the ability to effectively communicate solution to problems (oral, visual, written)
	CO-4	Analyzing capacity for critical reasoning and independent learning
	CO-5	Developing greater clarity about academic and career goals
TMUGS-501	**CO-1**	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings
	CO-2	Understanding and analyzing self and devising a strategy for self growth and development
	CO-3	Adapting a positive mindset conducive for growth through optimism and constructive thinking
	CO-4	Utilizing time in the most effective manner and avoiding procrastination.
	CO-5	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree
	CO-6	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.
TMUGA-501	**CO-1**	Applying the concepts of modern mathematics Divisibility rule, Remainder

		Theorem, HCF /LCM in Number System.
	CO-2	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.
	CO-3	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data.
	CO-4	Correlating the various arithmetic concepts to check sufficiency of data
ECS611	**CO-1**	Understanding the various components of data warehousing
	CO-2	Understanding the constructs and usage of R-Programming language for developers
	CO-3	Understanding how to design the physical model of data warehouse.
	CO-4	Understanding various algorithms of Data Mining and its process.
	CO-5	Applying the programming concept to solve problems using R-Programming.
	CO-6	Analyzing the concept of data mining using R-Programming.
	CO-7	Developing skills for analyzing and cleaning of the data.
EAI602	**CO-1**	Understanding the essential features of genetic algorithm (GA) and to evaluate the population, fitness and search space in it
	CO-2	Understanding the concepts of encoding, decoding in genetics and implement the various operators and features of GA.
	CO-3	Applying the optimization and searching techniques in search space.
	CO-4	Applying GA for building solutions to various problems and to study and evaluate the stopping criteria for the algorithm.
	CO-5	Analyzing and applying different crossover and mutation operators for effectively solving the desired real-world problems.
EAI603	**CO-1**	Understanding the requirement of Big data with respect to 5 V's
	CO-2	Understanding the basic storage structure used in Big data with respect to clusters
	CO-3	Understanding the Hadoop Ecosystem and its components
	CO-4	Applying the data processing in Big data with HIVE , PIG and HBASE.
	CO-5	Analyzing the functionality and working of Zookeeper for monitoring Servers in Cluster
EAI604	**CO-1**	Understanding the concept of knowledge representation and its various techniques
	CO-2	Understanding the concept of predicate logic, forward chaining, unification, Rate Algorithm
	CO-3	Understanding the concept of Default Reasoning Circumscription, Minimal Models, The Event Calculus Revisited, Default Logic, Auto epistemc Logic. Ontology and Description Logics and applying the reasoning in Multi-agent Systems Epistemic Logic and understand and apply Kripke Semantics in a Multi Agent Scenari
	CO-4	Understanding the concept of Frame and applying to demonstrate semantic net and understating the concept of Scripts, Script Applier Mechanism (SAM), Plan Applier Mechanism (PAM)and their mechanism and Top Down and Bottom Up Reasoning
	CO-5	Applying the concept of FOL to demonstrate Skolemization and understanding properties and categories of Knowledge representation, Reification and Abstract Entities, Resource Description Framework (RDF),

		The Event Calculus
EAI605	**CO-1**	Understanding the concepts of Pattern Recognition, its principles and various approaches.
	CO-2	Understanding the concepts of Statistical Pattern Recognition
	CO-3	Understanding various methods of parameter estimation like Maximum Likelihood, Bayesian parameter and also methods of dimension reduction.
	CO-4	Understanding the nonparametric techniques of pattern recognition like KNN et
	CO-5	Understanding the various techniques of Unsupervised Learning & Clustering.
EHM601	**CO-1**	Understanding the meaning and concepts of Entrepreneurship
	CO-2	Understanding the concepts and theories of motivation
	CO-3	Understanding different financing options
	CO-4	Understanding the government support policies and its applications
	CO-5	Understanding and applying remedies to sick businesses
EAI606	**CO-1**	Understanding the basic concept of mobile computing, wireless networks, structure of mobile computing based application.
	CO-2	Understanding various schemes like Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes .
	CO-3	Understanding the mobile IP, Key functionality of IP, Choose the required functionality at each layer for given application.
	CO-4	Analyzing solution for each functionality at each layer x Use simulator tools and design Ad hoc networks
	CO-5	Evaluating a mobile application and network concepts
EAI607	**CO-1**	Understanding the overview, limitations of existing operating system and study the classical problems related to IPC in operating system
	CO-2	Understanding the event handling and mutual exclusion in distributed system and further apply it to solve certain problems in distributed environment.
	CO-3	Understanding the recovery techniques along with fault tolerance issues and protocols
	CO-4	Understanding distributed file system and shared memory architecture and design issues.
	CO-5	Analyzing distributed deadlock and transaction
EAI608	**CO-1**	Understanding parallel computing, it's architecture, along with pipeline processing.
	CO-2	Understanding different processor architectures and system-level design processes.
	CO-3	Understand different interconnection network and learn the multiprocessor architecture.
	CO-4	Understanding of assembly level programming.
	CO-5	Analyzing multiprocessor scheduling strategies and models.
EAI609	**CO-1**	Understanding of the information system architecture and the involved components.
	CO-2	Understanding of the basic principles of Information Security, Online payment systems and related security issues along with the rules of E

		Governance.
	CO-3	Applying and regulating Cyber Laws dealing with Cyber Ethics by implementation of Intellectual Property Right in the areas of Copyright, Patent, Piracy and Plagiarism.
	CO-4	Analyzing the security of Cryptographic System and design and implementation issues related with Firewalls, Virtual Private Networks and Intrusion Detection Systems
	CO-5	Analyzing the need of physical security in Information System, need of Biometric Security System and related challenges.
EAI651	**CO-1**	Applying the concept to work with basic linux commands
	CO-2	Applying the concept to install a standalone Hadoop cluster Node
	CO-3	Applying the concept to read and write data into HDFS from Linux environment.
	CO-4	Analyzing the concept to solve a problem using MAP Reduce programming.
	CO-5	Analyzing the concept for data processing using HIVE.
ECS654	**CO-1**	Understanding Modeling and design of data warehouse
	CO-2	Understanding how to Install and Configure R Tool and R Studio.
	CO-3	Applying the concept to design a star and snowflake schema.
	CO-4	Analyzing R Explorer, Mining techniques and Attribute Relation File
	CO-5	Developing basic data warehouse applications along with the data visualization using R.
EAI653	**CO-1**	Understanding Arduino Experiments to ON, ON/OFF, BLINK LED light.
	CO-2	Understanding various structures of the data received through sensors in IOT
	CO-3	Applying Arduino Experiments using GPS to identify location.
	CO-4	Applying IOT to identify the different technologies.
	CO-5	Applying and Evaluate the use of different type of shields such as Bluetooth relay, Key –pad screw etc.
TMUGS-601	**CO-1**	Communicating effectively in a variety of public and interpersonal settings.
	CO-2	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.
	CO-3	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.
	CO-4	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.
	CO-5	Handling difficult situations with grace, style, and professionalism.
TMUGA-601	**CO-1**	Recognizing the rules of Crypt-arithmetic and relate them to find out the solutions
	CO-2	Illustrating the different concepts of Height and Distance and Functions.
	CO-3	Employing the concept of higher level reasoning in Clocks, Calendars and Puzzle Problems.
	CO-4	Correlating the various arithmetic and reasoning concepts in checking sufficiency of data
ECS716	**CO-1**	Understanding the different types of image transforms and their

		properties
	CO-2	Understanding the different techniques employed for the enhancement of images
	CO-3	Understanding the concept of image restoration & degradation models and color models.
	CO-4	Understanding the concept of supervised, un-supervised, and semi-supervised learning algorithms.
	CO-5	Analyzing different image compression techniques and their functionality.
EAI702	**CO-1**	Understanding basic concept of deep learning, ML vs AI vs DL, applications, linear algebra matrices, linear transformations, probability-distribution, mass function, density function, regression, classification, clustering, over-fitting, under-fitting, logistic regression, confusion matrix.
	CO-2	Understanding concept of neural network, classification model, multilayer feed forward neural network, back propagation learning, activation functions, loss functions for classification, hyper parameters-learning rate, regularization, momentum, sparsity.
	CO-3	Understanding concept of CNN, operations, feature selections, architecture of CNN, convolutional algorithms, random and unsupervised features, neuroscientific basis for CNN.
	CO-4	Understanding concept of optimization in training of deep models, challenges in NN optimization, algorithms used for optimization, optimization strategies and Meta-algorithms.
	CO-5	Applying neural network in TensorFlow, Sessions in TensorFlow, Logistic regression model, Beyond Gradient Descent model, momentum based optimization, gradient points in wrong direction
ECS709	**CO-1**	Understanding the Cloud Computing and its role in current scenario.
	CO-2	Understanding the different models of Cloud Computing and their limitations
	CO-3	Understanding the importance of Cloud services and economic factors related to them
	CO-4	Analyzing various risk factors involved in Cloud Computing and to tackle them using risk management techniques
	CO-5	Evaluating the virtual data centre architecture, governance strategy, security mechanism and contingency plans
EAI704	**CO-1**	Understanding basic concept of AI, knowledge acquisition, knowledge representation, expert system architecture, inference engine.
	CO-2	Understanding concept of neural ANN, neuron model, activation functions, NN architecture, supervised and unsupervised learning, applications of NN
	CO-3	Understanding concept of fuzzy rule, uncertainity, statistics and random processes, fuzzy sets, classical sets, operations on fuzzy and classical sets, crisp relations, properties of crisp relations, fuzzy relations
	CO-4	Understanding basic concept of genetic algorithms, reproduction, cross-over and mutation scaling, fitness, applications, neuro-fuzzy system, fuzzy-expert system, fuzzy-ga system
	CO-5	Applying concept of fuzzy arithmetic, fuzzy to crisp conversion, lambda cut for fuzzy relations, de-fuzzification, fuzzy transform, fuzzy set

		extension principle
EAI705	**CO-1**	Understanding of the history and background of web search, internet, WWW, web-search characteristics, spam, The Web Search Users, search engines, architecture of search engines. Crawling, indexing, and ranking and apply ranking concept to analysis page ranking algorithm.
	CO-2	Understanding the basic data mining concepts, Association Rules and Sequential Patterns, Generation of Frequent & Interesting item-sets, Mining with multiple minimum supports, Extended Model and Various Mining Algorithm
	CO-3	Understanding the concept Web crawling algorithms, Breadth First Search, Best First Search, A* Search, Adaptive A* Search, Page Rank algorithms for Ranking Google Sites
	CO-4	Understanding the basic concept of Web Spiders & Crawlers and various method of information retrieval
	CO-5	Applying the concept of web crawling and analysis the various web crawling algorithms
EAI706	**CO-1**	Understanding the VC dimension and PAC learning models for noise reduction, model selection and generalization
	CO-2	Understanding the role of Bayesian Decision theory for classification
	CO-3	Understanding the back propagation in multilayer neural networks and role of perceptron in ANN models
	CO-4	Understanding the concept of clustering and maximization algorithm
	CO-5	Applying dimensionality reduction principles for scaling and analysis of models
EAI707	**CO-1**	Understanding about non lineardimention reduction
	CO-2	Understanding dimensional reduction methods
	CO-3	Understanding various dimensionality reduction method
	CO-4	Analyzing PCA and its variants
	CO-5	Analyzing about real world actionability from analytics
EAI708	**CO-1**	Understanding and remember LISP and other functional programming paradigm.
	CO-2	Understanding and analyzing the first order logic for solving real world problems.
	CO-3	Understanding various knowledge representation methods.
	CO-4	Applying the reasoning capabilities under uncertain situations in any event
	CO-5	Analyzing the use of logic programming languages for AI and other domains.
EAI709	**CO-1**	Understanding the basic of R programming, datatypes, operators, understanding about debugging tools, date and time loop functions
	CO-2	Understanding data visualization, Create and customize visualizations using ggplot2
	CO-3	Understanding Linear algebra for data science, analyzing algebraic view: vectors, matrices, product of matrix vector, rank, null space, solution of overdetermined set of equations and pseudo-inverse.
	CO-4	Analyzing the Linear algebra for data science, geometric view: vectors, distance, projections, eigen value decomposition

	CO-5	Analyzing Linear Regression, Multiple Linear Regression, Linear Model selection.
ECS756	**CO-1**	Applying the spatial and frequency domain image enhancement techniques to enhance the brightness and contrast of the blurred images.
	CO-2	Applying the image enhancement and Image restoration & degradation models to improve the quality of blurred images.
	CO-3	Applying the loss less and lossy image compression techniques to reduce the number of required bits as much as possible without losing image visual quality.
	CO-4	Applying the image segmentation techniques to divide the images into subimages.
	CO-5	Applying the edge and line detection algorithms
EAI752	**CO-1**	Understanding the Python and libraries available for performing different tasks of deep learning applications
	CO-2	Understanding the procedure for reading data from various sources in Python
	CO-3	Understanding the role of Artificial Neural Network and its implementation in Deep Learning
	CO-4	Applying various deep learning algorithms on given data set for developing effective model
	CO-5	Analyzing the result generated by the model by changing parameters
EAI753	**CO-1**	Understanding the phases of SDLC and performing initial investigation about project
	CO-2	Understanding to design ER-Diagram and DFD of the project.
	CO-3	Applying the designing procedures to design database.
	CO-4	Developing SRS Document for the project
	CO-5	Developing Forms and Front end of the Project.
EHM801	**CO-1**	Understanding Project Management & its evaluation
	CO-2	Understanding and analyzing the technical feasibility of a project
	CO-3	Understanding financial system and analyzing the use of funding mechanism
	CO-4	Understanding the application of laws related to business and project execution
	CO-5	Understanding Financial Accounting and Financial Statements for business
EAI802	**CO-1**	Understanding the functions, types and design parameters for shallow neural network and its usage in machine learning
	CO-2	Understanding major deep learning algorithms using RNN, the problem settings, and their applications to solve real world problems
	CO-3	Analyzing the sentiments using NLP and further apply the concepts to determine the polarity of sentiments
	CO-4	Analyzing the deep learning algorithms which are more appropriate for various types of learning tasks in various domains
	CO-5	Developing deep learning algorithms using some advance concepts and try to solve real-world problems.
EAI803	**CO-1**	Understanding the Forensic Science procedures and their role in cyber computing

	CO-2	Understanding the importance of evidences, their types, recovery and preservation procedures
	CO-3	Understanding the steganography, cloaking and backup techniques for cyber security
	CO-4	Understanding the security threats and common security standards & techniques available to secure the computer resources
	CO-5	Understanding the key elements of Machine Learning for solving complex problems and application areas of ML
EAI804	**CO-1**	Understanding the elements of Reinforcement Learning and in what aspects it is similar or different from Machine Learning
	CO-2	Understanding the challenges before Reinforcement Learning and role of OpenAI to resolve them
	CO-3	Applying Tensor Flow framework for implementing policy gradients, learning buffers in Convolution Neural Network (CNN)
	CO-4	Analyzing the impact of dynamic programming algorithms and Monte Carlo methods on learning of RL models
	CO-5	Analyzing the performance of Bandit algorithms, Markov decision and Markov reward process
EAI805	**CO-1**	Understanding the concept of sensors signals, sensor classification, sensor characteristics and unit of measurement of different sensors.
	CO-2	Understanding the concept of physical characteristics of sensors like sensing of electric charge, Fields, Potentials, Magnetism, Induction, Resistance, temperature and thermal properties of material, dynamic models of sensor elements.
	CO-3	Understanding the concept of Input Characteristics of Interface Circuits like Amplifiers, Analog to Digital Converters, Digitization processing, data transmission and batteries for law power sensors.
	CO-4	Understanding the concept of different types of sensor with different types of sensors application.
	CO-5	Understanding the concept of different sensor materials, uses of NanoTechnology to create sensors and smart sensors.
EAI806	**CO-1**	Understanding the concept of security concern with IoT Applications, secure IoT Architecture, types of attacks, maintaining privacy of data gathered by smart IoT devices.
	CO-2	Understanding the concept of cryptography like encryption, decryption, Hashes, digital signature, security key management, IoT node authentication etc
	CO-3	Understanding the concept of identification by authorization, IAM architecture, Publish-Subscribe schemes
	CO-4	Understanding the concept of privacy preservation using lightweight and robust schemes, Trust models and preventing unauthorized access in data dissemination.
	CO-5	Analyzing the concept of cloud security in which data is gathered from different IoT devices by different cloud security controls and Enterprise-IoT cloud security architecture
EAI808	**CO-1**	Understanding the need of automation and basic structure, control system & different controllers used in Robotics

	CO-2	Understanding the importance of sensors and actuators in design of Robots
	CO-3	Understanding the process of image processing, image analysis and training to develop vision system for Robot
	CO-4	Understanding the methods of Robot programming with their limitations
	CO-5	Developing robotic applications by using Arduino UNO, Raspberry Pi and Python
ECS814	**CO-1**	Understanding of the history of Block-chain, different models and protocols
	CO-2	Understanding the basic of crypto-currency and different algorithms used in it
	CO-3	Understanding the concept of Bitcoin and analysis of its properties using mathematical induction
	CO-4	Understanding the concept of Ethereum, Ethereum Virtual Machine (EVM) and smart concepts
	CO-5	Understanding the concept of Zero Knowledge proofs and protocols
EAI753	**CO-1**	Applying the concepts to perform the exploratory data analysis
	CO-2	Applying dialog generation using Deep reinforcement learning
	CO-3	Applying the learnt concepts for performing the face recognition using modern deep learning methods such as CNN.
	CO-4	Applying RNN for text and document summarization.
	CO-5	Developing the deep neural network for solving the real-world task of recognizing images.
EAI852	**CO-1**	Understanding the process of Project development.
	CO-2	Applying the knowledge to develop applications based on deep learning.
	CO-3	Applying the learning to develop applications on different platforms like Window, Web based or Mobile based applications to specific set of problem and their solutions.
	CO-4	Developing face recognition models using NN
	CO-5	Developing methods for text summarization and classification