Teerthanker Mahaveer University
College of Computing Sciences & IT

B.Tech. (Computer Sciences and Engineering)
Application Development using Cloud & Analytics Platform (In Collaboration with IBM)

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.

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	**:**	Developing skills of practical competency with emerging technologies, programming languages and open source platforms.

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 the fundamentals of OOPS basic terminology used

	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.
IBD331	**CO-1**	Understanding the fundamentals of OOPS basic terminology used
	CO-2	Understanding basics of various methods used for computations like Seeing, Applet
	CO-3	Understanding the concept of object oriented model
	CO-4	Analyzing the efficiency of various machines based upon their functionality and limitations
	CO-5	Applying the concepts to design various machines.
EEC302	**CO-1**	Understanding of the fundamental concepts and techniques used in digital electronics.
	CO-2	Understanding and examine the structure of various number systems and its application in digital design.
	CO-3	Understanding, analyzing and design various combinational and sequential circuits.
	CO-4	Understand the operation of electronic logic elements
	CO-5	Understanding To develop skill to build, and troubleshoot digital circuits.
	CO-6	Analyzing and prevent various hazards and timing problems in a digital design.
EAS301	**CO-1**	Understanding the concepts of singularities, zeroes and poles, functions , relations, propositions, truth tables, logical equivalence and implications, converse, inverse, biconditional 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
EAS303	**CO-1**	Understanding the Importance of Science & Technology for the welfare of humanity,
	CO-2	Understanding the Human and Ethical perspectives in developing and using Technologies
	CO-3	Understanding the Ethical Responsibilities and its application for business, profession and organizational groups
	CO-4	Understanding the individual & corporate responsibilities in regard of society

	CO-5	Remembering the Inculcate the habits of human values, moralities in profession and crisis management
TMUGE201	**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	Aanalyzing different types of sentences like simple, compound and complex.
	CO-5	Drafting notice, agenda and minutes of the meeting.
	CO-6	Demonstrating speaking skills during common conversation and power point presentation.
TMUGE201	**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 relation and Direction.
	CO-4	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.
ECS355	**CO-1**	Analyzing Data representation and operations using tree and graph
	CO-2	Analyzing the Concept of recursion and its types with examples
	CO-3	Implementing all the operations on Stack, Queue, and Linked List.
	CO-4	Implementing of sorting techniques
	CO-5	Implementing of searching techniques
IBD351	**CO-1**	Analyzing the concept of object oriented model.
	CO-2	Analyzing the efficiency of various machines based upon their functionality and limitations.
	CO-3	Applying the concepts to design various machines
	CO-4	Implementing basics of various methods used for computations like Swing, Applet
	CO-5	Implementing the concept of OOPS basic terminology used.
EEC351	**CO-1**	Analyzing different combinational circuits with its truth table.
	CO-2	Implementing of various registers and transistor.
	CO-3	Implementing of CMOS integrated circuit and conversion.
	CO-4	Implementing the BCD to binary conversion
	CO-5	Implementing the GATES to conversion
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	Analyzing the efficiency of various machines based upon their functionality and limitations
	CO-5	Applying the concepts to design various machines like FSM, PDA etc.
ECS405	**CO-1**	Understanding to find solutions of non-linear equations using bisection method, Newton's methods and False Position method and implement

		using a computer. Also solve integration with the help of Trapezoidal rule and Simpson's rules.
	CO-2	Applying to solve large systems of simultaneous linear equations
	CO-3	Applying to Solve Finite differences with the help of some operators like Shift operator and also find data after analysis of given data using various numerical methods like Newton's method, Lagrange's method etc and implement using a computer
	CO-4	Analyzing the Employ appropriate regression models to determine statistical relationships
	CO-5	Applying basic statistical inference techniques, including confidence intervals, hypothesis testing and analysis of variance, to science/engineering problems.
IBD411	**CO-1**	Understanding importance of databases in real life.
	CO-2	Understand the operation of electronic logic elements
	CO-3	Understanding to Bloom the Triggers and Views in databases
	CO-4	Understanding Entity-Relationship model
	CO-5	Understanding the Grasp about the SQL, Oracle Database queries.
	CO-6	Analyzing to Learn different types of databases.
IBD413	**CO-1**	Understanding the Blooming in the techniques used in agile and their benefits.
	CO-2	Understanding the lifecycle of a project, including alternative configurations and other project management models.
	CO-3	Understanding how the Agile Project Management process can enable planning, management and control for predictable agile project deliveries
	CO-4	Analyzing the roles and responsibilities within agile projects.
	CO-5	Analyzing the philosophy and principles of Agile
	CO-1	Understanding the concepts and implementation of various Memory management policies and usage of the virtual memory.
ECS406	**CO-2**	Understanding the concepts and states of process, also evaluating the use of various scheduling algorithms and finding the suitability for their usage
	CO-3	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-4	Analyzing and Understanding the Basics of operating system along with the types and main functionalities of the operating system.
	CO-5	Analyzing the file management policies and disk structure along with scheduling algorithm for applying it to solve the disk scheduling problems.
EHM403	**CO-1**	Understanding the Concept and importance of management
	CO-2	Understanding the Perception and Thinking process of individual, personality traits its important
	CO-3	Understanding the Theories of motivation and leadership and its importance, applicability into business
	CO-4	Understanding the Flow and formation of powers and politics in organizational groups
	CO-5	Understanding the Organizational Change and its importance,
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
	CO-5	Aanalyzing different types of interviews.
ECS453	**CO-1**	Applying floating point arithmetic operations and deduce errors involve in polynomial interpolation.
	CO-2	Applying Algebraic and transcendental equation
	CO-3	Applying formulae by Bessel's, Newton, Sterling, and Lagrange's.
	CO-4	Applying method of least square and showing frequency chart, regression
	CO-5	Applying numerical integration and differentiations.
IBD451	**CO-1**	Applying to Execute different queries to create a simple and complex
	CO-2	Implementing the different functions on the given table.
	CO-3	Applying to execute how to deal with different tables in one database.
	CO-4	Analyzing the steps to create any database from scratch using ER model.
	CO-5	Applying to Execute patterns to retrieve data from table.
IBD453	**CO-1**	Implementing the software projects in a continuous and faster way.
	CO-2	Implementing the various tools used in DevOps and applying them in project development.
	CO-3	Implementing the commands used in DevOps tools.
	CO-4	Implementing the various communication and team collaboration techniques used in software development process.
	CO-5	Applying the DevOps approach in the project development to increase speed, efficiency and decrease risk
ECS455	**CO-1**	Understanding various methods to perform the basic operations on a UNIX based operating system.
	CO-2	Applying the concept to implement and simulate the various CPU scheduling and Page replacement algorithms.
	CO-3	Applying the file read, write and access methods and perform the operations on a file in UNIX.
	CO-4	Analyzing the methods for creating SRS and various diagrams using software engineering paradigms
	CO-5	Analyzing the methods for creating flowchart to show process flow.
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 Syllogisms and Venn diagram.
	CO-4	Examining the optimized approach to solve logs and Surds.
ECS511	**CO-1**	Understanding the theory and architecture of central processing unit.
	CO-2	Understanding the concepts of parallel processing, pipelining and interprocessor communication.
	CO-3	Understanding the impact of instruction set architecture on cost-performance of computer design.
	CO-4	Understanding dynamic scheduling methods and their adaptation to contemporary microprocessor design.
	CO-5	Analyzing microprocessor architecture and apply assembly language programming.

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 concept of graph problem to get solutions of depth first search method, breadth first search method, back tracking, 8-queen problem, knapsack problem.
	CO-5	Analyzing the concept of branch and bound method, LC searching bounding, FIFO branch and bound, 0/1 knapsack problem, travelling salesman problem, complexity measures, polynomial v/s non-polynomial time complexity, NP-hard and NP-complete problem.
ECS510	**CO-1**	Understanding the fundamentals of computer networks, their types, transmission modes, and various reference models.
	CO-2	Understanding error-free transmission of data along with data collision.
	CO-3	Understanding addressing techniques and transmission modes of a network.
	CO-4	Understanding the working of application layer protocols and the impact of network security tools on an existing systems.
	CO-5	Applying various routing and congestion control algorithms over a network and Identify Quality of service parameters and addressing techniques.
IBD514	**CO-1**	Understanding to Earn basic knowledge of Cloud Technologies in use today
	CO-2	Understanding the Importance of security in cloud computing
	CO-3	Understanding Cloud Segments and Cloud Deployment Models
	CO-4	Analyzing the Strategic plan to move applications and services to the Cloud
	CO-5	Analyzing the Static Application Development using Service models
IBD515	**CO-1**	Understanding to Earn basic knowledge of Hadoop fundamental
	CO-2	Understanding the Importance of security in Hadoop
	CO-3	Understanding Segments and HiveDeployment Models
	CO-4	Analyzing the Strategic plan to move applications and services to big data
	CO-5	Analyzing the Static Application Development using Service models
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
ECS591	**CO-1**	Understanding knowledge through research and development on latest technology.
	CO-2	Developing greater clarity about academic and career goals
	CO-3	Understanding of administrative functions and company culture
	CO-4	Applying critical reasoning and independent learning
	CO-5	Developing ability to effectively communicate solution to problems (oral, visual, written).
ECS506	**CO-1**	Applying the waterfall model in the development of ERP applications.
	CO-2	Analyzing the design and implementation of an e-commerce application with a shopping cart.
	CO-3	Analyzing the user-centered design guidelines in developing user-friendly websites.
	CO-4	Analyzing the bullwhip effect in a supply chain, analyze the causes, and recommend possible solutions.
	CO-5	Analyzing different types of portal technologies and deployment methodologies commonly used in the industry
EHM504	**CO-1**	Understanding meaning of Economics/Managerial Economics and its applicability
	CO-2	Understanding theories of consumer behavior, demand & supply analysis
	CO-3	Understanding Demand forecasting in business, Law of production and returns
	CO-4	Understanding market, structures and evaluation of price mechanism in different conditions
	CO-5	Understanding Correlation of macro and microeconomics concepts and business practices
ECS512	**CO-1**	Understanding the term „e-commerce" and the need of ecommerce.
	CO-2	Understanding the role of information systems in organizations, the strategic management processes, and the implications for the management.
	CO-3	Understanding about the importance of managing organizational change associated with information systems implementation.
	CO-4	Applying the application software skills such as analyzing spreadsheets, creating database, and Web browsing, that they have learned in other courses to apply to real-world business problems.
	CO-5	Analyzing the importance of managing organizational change associated with information systems implementation.
ECS513	**CO-1**	Understanding the processes that exist primarily for supporting the management of software development, and are generally skewed toward addressing business concerns
	CO-2	Understanding the concepts to address specific management needs at the individual, team, division and/or organizational level

	CO-3	Applying a strong working knowledge of ethics and professional responsibility. Understanding effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
	CO-4	Analyzing the leadership effectiveness in organizations ,team-building skills required to support successful performance
	CO-5	Analyzing the selection and initiation of individual projects and of portfolios of projects in the enterprise.
	CO-6	Analyzing project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
	CO-7	Developing Practical applications of project management to formulate strategies allowing organizations to achieve strategic goals
ECS514	**CO-1**	Understanding software testing
	CO-2	Understanding Basic concepts of Test Management
	CO-3	Applying Agile Methodology of software testing. Understanding how to author a software testing plan. Analyzing software Maintenance
	CO-4	Analyzing Black Box Techniques
	CO-5	Analyzing Control Flow & Data Flow. White Box Techniques: Cyclomatic Complexity
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
IBD553	**CO-1**	Applying the Static Application Development using Service models
	CO-2	Implementing the Strategic plan to move applications and services to the Cloud
	CO-3	Implementing Cloud Segments and Cloud Deployment Models
	CO-4	Implementing the Importance of security in cloud computing
	CO-5	Implementing basic knowledge of Cloud Technologies in use today
IBD554	**CO-1**	Applying the Strategic plan to move applications and services to big data
	CO-2	Implementing basic knowledge of Hadoop fundamental
	CO-3	Implementing Segments and HiveDeployment Models
	CO-4	Implementing the Importance of security in Hadoop
	CO-5	Implementing the Static Application Development using Service models
ECS555	**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	Evaluating Various latest AI models and technologies in real world to shape the career.
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
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.
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
ECS612	**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	Understanding the hand-off process in mobile communication
	CO-5	Analyzing solution for each functionality at each layer x Use simulator tools and design Ad hoc networks
IBD613	**CO-1**	Understanding the Concept of Big data and traditional data all its major differences and topics.
	CO-2	Understanding the Tools which are used to perform Operations on big Data
	CO-3	Understanding AI , ML and DL with its major modules
	CO-4	Analyzing the Different Alternatives Hadoop Tools and Hadoop Alternatives itself CO-4 Grasp all the relation between Big Data And Data Science
	CO-5	Analyzing the Live Working on IBM Watson Notebook Services

EHM601	**CO-1**	Understanding the meaning and concepts of Entrepreneurship
	CO-2	Understanding and applying the concepts and theories of motivation Analyzing different facet and forms of business
	CO-3	Understand, apply and evaluate different financing options
	CO-4	Understanding the government support policies and its applications
	CO-5	Understanding and applying remedies to sick businesses
ECS606	**CO-1**	Understanding fundamentals of microprocessor 8085 and microprocessor 8086.
	CO-2	Understanding the concept of assembly language programming.
	CO-3	Understanding the concept of CPU module and peripheral interfaces.
	CO-4	Applying the concept of assembly language to solve problems.
	CO-5	Analyzing the architecture and salient features of microprocessor and microcontrollers.
ECS607	**CO-1**	Understanding the architecture and algorithms for artificial neural network.
	CO-2	Understanding the classical and fuzzy set along with membership function.
	CO-3	Applying the learnt concept for solving the numerical problems using fuzzy operations.
	CO-4	Applying fuzzy arithmetic and approximate reasoning on fuzzy sets.
	CO-5	Developing the uncertainty and non specificity for fuzzy and crisp set.
EEC606	**CO-1**	Understanding fundamentals of microprocessor 8085 and microprocessor 8086.
	CO-2	Understanding the concept of assembly language programming.
	CO-3	Understanding the concept of CPU module and peripheral interfaces.
	CO-4	Applying the concept of assembly language to solve problems.
	CO-5	Analyzing the architecture and salient features of microprocessor and microcontrollers.
ECS603	**CO-1**	Understanding the basics concepts of computer graphics
	CO-2	Understanding output primitives generating algorithms
	CO-3	Understanding 2d and 3d transformation techniques
	CO-4	Understanding the concepts of window/viewport transformation
	CO-5	Understanding the concept of computer animation
ECS610	**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.
ECS614	**CO-1**	Understanding multimedia, it‟s applications, supporting hardware and

		hardware tools which provide basic information about multimedia
	CO-2	Applying various tools on image and video standards using JPEG, MPEG, MHEG along with color models and multimedia monitor bitmaps to properly represent a multimedia application.
	CO-3	Applying the multimedia drawing tools and techniques with the effect of animation using multi layer concepts supported by flash incorporating text, audio, video and graphics.
	CO-4	Applying the different compression approaches like lossy and lossless with the specifications of sampling variables associated with digital audio
	CO-5	Analyzing the basic information about the phase performing planning and production of a multimedia application using it‟s objects like text, sound and their specifications like MIDI with proper capturing.
ECS613	**CO-1**	Understanding the structure along with the lexical and syntactic analysis phase of a compiler.
	CO-2	Understanding various parsing techniques.
	CO-3	Understanding the intermediate code paradigms and apply them for solving various translation schemes.
	CO-4	Applying the various code optimization techniques and study code generation.
	CO-5	Analyzing the memory allocation schemes and the error detection on phases of compilation.
IBD653	**CO-1**	Understand the Execution Processing Hadoop frame working cluding HDFS and Map reduce
	CO-2	Understand the Data Science process Cycle with examples
	CO-3	Implementing Execute the Hadoop tools like Hive, pig, Sqoop ,hBaseetc
	CO-4	Implementing Execute the modules related to AI,ML and DL
	CO-5	Applying Live working on Jupyter Notebook on WatsonStudio
	CO-6	Applying Live Working on Spark on Watson using Scala ,python and R
IBD654	**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.
	CO-6	Understanding Modeling and design of data warehouse.
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.
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.
IBD715	**CO-1**	Understanding the detail concept of spring In real life.
	CO-2	Understanding the concept of Spring Framework easy from other programming Languages.
	CO-3	Understanding Machine Learning with some modules.
	CO-4	Understanding the Grasp how the data is predicted in spring framework.
	CO-5	Analyzing the relationship between spring and Hibernate.
ECS703	**CO-1**	Understanding vulnerability and the weaknesses of unsecured network
	CO-2	Understanding information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of network security.
	CO-3	Applying different encryption and decryption techniques to solve problems related to confidentiality and authentication
	CO-4	Analyzing the performance of different encryption algorithms for verifying the integrity of varying message sizes.
	CO-5	Analyzing different digital signature algorithms to achieve authentication and create secure applications
	CO-6	Developing a secure network system using cryptographic utilities and authentication mechanisms.
IBD713	**CO-1**	Understanding the DB2 Environment and Command Line Processor.
	CO-2	Understanding the concepts of Locking and Concurrency in DB2.
	CO-3	Understanding the Security Issues in DB2 and also the problem determination.
	CO-4	Applying DB2 queries to create Backup and Recovery.
	CO-5	Applying Database, Database Objects like Stored Procedure, Functions
IBD716	**CO-1**	Understanding of the history of AI and different classical AI algorithms
	CO-2	Applying basic principle of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
	CO-3	Understanding awareness and fundamental understanding the various concepts of Prolog and Symbolic and Monotonic and non monotonic reasoning
	CO-4	Understanding the concept of knowledge representation techniques called slot, filler and Natural Language processing
	CO-5	Understanding the concept of Expert System and its Components and demonstrate the working of MYCIN AND DENDRAL expert system tools
ECS713	**CO-1**	Understanding the concept of loss less and lossy data compression techniques.
	CO-2	Understanding the methods of loss less image compression, text compression, and audio compression.
	CO-3	Understanding statistical basis and performance metrics for lossless as well as lossy compression
	CO-4	Analyzing the operation of a range of commonly used Compression techniques
	CO-5	Applying loss less and lossy data compression techniques in real-world

		applications.
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.
	CO-4	Understanding various image compression and color models like RGB, CMY.
	CO-5	Analyzing various image segmentation techniques to segment the digital image into sub-images.
ECS717	**CO-1**	Understanding the android framework
	CO-2	Understanding the various application components
	CO-3	Understanding view and viewgroup objects
	CO-4	Understanding custom views
	CO-5	Understanding different classes and interfaces which deals with database
	CO-6	Developing small android applications related to specific domain
ECS754	**CO-1**	Applying Huffman Coding algorithm in data compression.
	CO-2	Applying LZ77 approach in data compression.
	CO-3	Applying LZ78 approach in data compression.
	CO-4	Applying binary code algorithm for compression.
	CO-5	Applying partial match in prediction.
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.
	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 sub-images.
	CO-5	Applying degradation models to improve the quality of blurred images.
ECS757	**CO-1**	Understanding Activity
	CO-2	Understanding view system
	CO-3	Understanding menu and its types
	CO-4	Applying the web services and map based activity
	CO-5	Developing small android based applications.
IBD753	**CO-1**	Applying Database, Database Objects like Stored Procedure, Functions
	CO-2	Applying DB2 queries to create Backup and Recovery.
	CO-3	Applying the queries of DB2 to implement Locking and concurrency.
	CO-4	Applying Application performance tools to check the performance of Objects.
	CO-5	Applying queries of DB2 to implement security.
IBD755	**CO-1**	Understanding the execution of Spring framework In real life.
	CO-2	Implementing the different modules to predict data.
	CO-3	Implementing to Execute different functions to search pattern in the files.
	CO-4	Analyzing the data from different datasets with different modules.
	CO-5	Applying the concept of Spring framework.

IBD756	**CO-1**	Understanding the role of PROLOG for implementation of solutions of AI problems
	CO-2	Understanding the architecture and evaluation scheme of PROLOG
	CO-3	Applying the PROLOG for solving trivial problems
	CO-4	Applying the solutions for Water Jug problem, Eight Puzzle problem, Monkey Banana problem using PROLOG
	CO-5	Applying the various knowledge representation structures.
ECS791	**CO-1**	Understanding research and development on latest technology.
	CO-2	Understanding greater clarity about academic and career goals
	CO-3	Understanding of administrative functions and company culture
	CO-4	Analyzing a capacity for critical reasoning and independent learning
	CO-5	Developing ability to effectively communicate solution to problems (oral, visual, written).
ECS799	**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 analysis the technical feasibility of a project
	CO-3	Understanding financial system and analyze 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
ECS812	**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	Analyzing 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.
ECS811	**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 dimensionality reduction principles for scaling and analysis of models
	CO-4	Understanding the concept of clustering and maximization algorithm
	CO-5	Understanding the back propagation in multilayer neural networks and role of perceptrons in ANN models
ECS809	**CO-1**	Understanding the concept of a pattern and the various approaches of pattern recognition.
	CO-2	Understanding the basic methods of feature extraction, feature evaluation, and dimension reduction of feature vectors.
	CO-3	Understanding various supervised and unsupervised learning approaches.

	CO-4	Understanding machine learning concepts and range of problems that can be handled by machine learning.
	CO-5	Applying both supervised and unsupervised classification methods to detect and characterize patterns in real-world data.
ECS810	**CO-1**	Understanding the human brain, role of neurons, neuroscience, neuro-computing and learning process in neurons
	CO-2	Understanding the basic models and functions of neurons & perceptrons
	CO-3	Analyzing the role of mean square and gradient descent algorithm for non linearly separable problems
	CO-4	Analyzing the model consisting of multilayer neurons using back propagation for better reliability and approximation
	CO-5	Applying the principal component, features of Recurrent network and temporal feed forward network and display their computer simulation
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
ECS805	**CO-1**	Understanding fundamental characteristics of distributed system.
	CO-2	Understanding the concept of distributed objects and remote invocation methods.
	CO-3	Understanding different distributed models for remote communication.
	CO-4	Understanding the security mechanism and protocols for distributed transactions.
	CO-5	Analyzing the concept of distributed algorithms and their performance associated with security issues and distributed deadlock.
ECS812	**CO-1**	Understanding the concepts of IOT
	CO-2	Understanding the architecture, different models and design principles of IOT.
	CO-3	Understanding the different technologies related to IOT.
	CO-4	Understanding the concepts of smart city development in IOT.
	CO-5	Applying IOT concepts in real word scenario like industrial automation, wireless communication etc.
ECS813	**CO-1**	Understanding the learning and different types of learning approaches that could be used for implementing Machine Learning problems.
	CO-2	Understanding the key elements of Machine Learning and the importance of model selection and generalization
	CO-3	Understanding the various components of Bayesian Decision Theory and Dimensionality Reduction for solving Machine Learning problems
	CO-4	Understanding the various approaches of Clustering and Classification for improving the learning capability of machine
	CO-5	Understanding the functions based on various rules and parameters for implementing competitive learning in Machine Learning

	CO-6	Understanding the Artificial Neural Network based multilayer networks supporting both forward and backward propagation
	CO7.	Understanding the Deep Learning and how it is different from Machine Learning and areas where Deep Learning is implemented
	CO8.	Evaluating multiple supervised learning algorithms and select the best suitable for a specific problem
ECS855	**CO-1**	understanding 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	Applying the concept to solve a problem using MAP Reduce programming.
	CO-5	Analyzing the concept for data processing using HIVE.
ECS899	**CO-1**	Understanding the process of Project development.
	CO-2	Applying the knowledge to develop applications based on SRS Document.
	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	Evaluating the test cases results after testing of the project along with different roles.
	CO-5	Developing good quality project to solve real world applications.