Teerthanker Mahaveer University
Faulty of Engineering
B.Sc. (H) Mathematics

Programme Outcomes

PO – 1	Critical thinking - This is based on the assumption, thinking and actions. These assumptions are tested for accuracy & validity taking into consideration the ideas and decisions. These ideas may be collected from intellectual organization or personal from different prospectus.
PO – 2	Effective communication- Effective communication an important tool to enhance the effectiveness of learning among the students. The speaking, reading & writing must be followed correctly.
PO – 3	Social interaction –Social interaction also play important role to reads the conclusion in group settings.
PO – 4	Effective citizenship- This contributes in the national development and promptness to achieve the goals. It develops awareness through volunteering.
PO – 5	Ethics- It has direct impact to recognize the different value systems. It gives proper understanding in different dimension for making decisions.
PO – 6	Environment and sustainability- Essential to understand the environmental issues & sustainable development.
PO – 7	Self directed & lifelong learning – Acquire the ability to engage in independent and life- long learning in broad spectrum including socio technological changes.
PO- 8	Problem analysis & Solving: Identify, formulate, research literature, and analyze complex basic sciences problems reaching substantiated conclusions using first principles of mathematics, natural sciences.
PO- 9	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- 10	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- 11	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 Outcomes

PSO – 1	Understanding the value and importance of critical manner.
PSO – 2	Understanding in the advance areas of mathematics and statistics of their respective chosen area.
PSO – 3	Applying the techniques & mathematical models on the need of requirement and analyzing the available information for solving various Problems.
PSO – 4	Analyzing and developing mathematical arguments or models in a logical manner.
PSO – 5	Evaluating quantitative models arising in social science, business and other contexts.
PSO – 6	Creating and applying appropriate techniques, resources and modern technology in multidisciplinary environment.

Course Outcomes

BAS 116	CO1.	Understanding the relation between linear equation and its matrix representation.
	CO2.	Understanding the basic algebraic equations and groups.
	CO3.	Understanding the concepts of inverse, Eigen values and their corresponding Eigen vectors.
	CO4.	Analyzing the mathematical statements & its results.
	CO5.	Analyzing the system of linear equations, consistency & dependency.
BAS117	CO1.	Understanding the concepts of trigonometric functions, hyperbolic functions, inverse circular and inverse hyperbolic functions of complex quantities.
	CO2.	Understanding the concept of Successive differentiation and partial differentiation.
	CO3.	Understanding the concepts of envelopes, evolutes, curvature and asymptotes of curves in Cartesian and polar coordinates.
	CO4.	Applying the concept of Leibnitz's theorem for successive derivatives.
	CO5.	Applying the concept of tangent, normal and asymptotes to tracing of curves in Cartesian, parametric and polar coordinates.
TMUGE101	CO1.	Remembering and understanding of the basic of English grammar and vocabulary.
	CO2.	Understanding of the basic Communication process.
	CO3.	Applying correct vocabulary and tenses in sentences construction.
	CO4.	Analyzing communication needs and developing communication strategies using both verbal & non-verbal method.

	CO5.	Drafting applications in correct format for common issues.
TMUGA-101	CO1.	Solving complex problems using Criss cross method, base method and square techniques.
	CO2.	Applying the arithmetical concepts of Average, Mixture and Allegation.
	CO3.	Evaluating the different possibilities of various reasoning based problems in series, Blood relation and Direction.
	CO4.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.
BAS115	CO1.	Remembering & understanding the concepts of atomic structure, periodic properties of elements.
	CO2.	Remembering & understanding the concepts of Chemical bonding.
	CO3.	Understanding the concepts of organic chemistry &various types of organic reaction & their mechanism.
	CO4.	Applying chemical bonding in explaining the bonding characteristics of molecules.
	CO5.	Analyzing the organic reactions and their mechanism.
BAS121	CO1.	Remembering the concepts of optical phenomena like reflection, refraction, interference, diffraction & waves.
	CO2.	Understanding the principles of divisions of waves.
	CO3.	Applying the Fermat's principle to understand the optical phenomena.
	CO4.	Applying the concept of superposition of waves to draw the Lissajous Figures.
	CO5.	Applying the concept of diffraction phenomenon or using to single and multi-slit to find out the dispersive and resolving power of different optical devices like telescope, microscope and gratings.
	CO6.	Applying the concept of interference and diffraction phenomenon to Construct and reconstruct the holograms using two plane waves as well as zone plates.
BCS111	CO1.	Understanding the concept of various components of computer system
	CO2.	Understanding the Object-Oriented Programming Language concepts.
	CO3.	Analyzing basic mathematical problem and their solutions through programming
	CO4.	Applying the concepts of programming solutions for distinct problems
	CO5.	Applying the concepts of scalable solutions through function

BAS161	CO1.	Analyzing the extra elements (N, S, Cl, Br, I) in the given organic compounds by Lassaigne test.
	CO2.	Analyzing of functional group in the given organic compounds.
	CO3.	Analyzing the Fe (II) and Cu (II) in the given sample of water by Oxidation-Reduction Titrimetric.
	CO4.	Analyzing the total hardness of a given sample of water by complexometric titration.
	CO5.	Creating of Potash alum and Chrome Alum.
BAS171	CO1.	Remembering the concepts of optical properties and character of lights.
	CO2.	Understanding the concepts to measure the focal lengths of concave, convex lenses and mirrors.
	CO3.	Applying the concepts of Schuster's method for optical adjustment of spectrometer.
	CO4.	Analyzing the diffraction and interference patterns obtained from different optical instruments.
	CO5.	Analyzing the dispersive power to verify the prism materials.
BCS161	CO1.	Understanding the concepts of execution to programs written in C language.
	CO2.	Applying to prepare programming solutions for specific problems.
	CO3.	Applying to prepare scalable solutions through functions.
	CO4.	Applying basic elements of a C program including arithmetic and logical operators, functions, control structures, and arrays
	CO5.	Analyzing basic mathematical problem and their solutions through programming.
BAS 216	CO1.	Understanding the concepts of differentiate and anti-differentiate a vector-valued function presented in symbolic form.
	CO2.	Understanding the concepts of relationship between position functions, velocity functions, acceleration functions, and speed functions.
	CO3.	Understanding the concepts of normal and tangential components of acceleration.
	CO4.	Applying the concepts of Integrate functions of several variables over curves and surfaces.
	CO5.	Applying the concepts of Green's theorem & Divergence theorem to compute integrals.
BAS 217	CO1.	Understanding the concepts of limit and sum of limit, anti-derivative.
	CO2.	Understanding the concepts of area & volume of curves and solids.

	CO3.	Understanding the concepts of special functions.
	CO4.	Applying the concepts of integral calculus to solve geometrical problems.
	CO5.	Applying the concepts of Drichlet's integral for volume and surfaces of revolutions.
TMUGE201	CO1.	Remembering & understanding the basics of English Grammar and Vocabulary.
	CO2.	Understanding the basics of Listening, Speaking & Writing Skills.
	CO3.	Understanding principles of letter drafting and various types of formats.
	CO4.	Applying correct vocabulary and grammar in sentence construction while writing and delivering presentations.
	CO5.	Analyzing different types of listening, role of Audience & Locale in presentation.
	CO6.	Drafting Official Letters, E-Mail & Paragraphs in correct format.
TMU201	CO1.	Understanding environmental problems arising due to constructional and developmental activities.
	CO2.	Understanding the natural resources and suitable methods for conservation of resources for sustainable development.
	CO3.	Understanding the importance of ecosystem and biodiversity and its conservation for maintaining ecological balance.
	CO4.	Understanding the types and adverse effects of various environmental pollutants and their abatement devices.
	CO5.	Understanding Greenhouse effect, various Environmental laws, impact of human population explosion, environment protection movements, different disasters and their management.
TMUGA-201	CO1.	Applying the arithmetical concepts in Ratio Proportion Variation.
	CO2.	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work, Time Speed and Distance.
	CO3.	Identifying different possibilities of reasoning based problems of Syllogisms and Venn diagram.
	CO4.	Examining the optimized approach to solve logs and Surds.
BAS215	CO1.	Understanding the concept of kinetic theory of gases and behavior of real gases.
	CO2.	Understanding the effect of solute and temperature on the physical properties of liquids.
	CO3.	Understanding the elements of symmetry, crystal structure of ionic compounds.
	CO4.	Understanding the Ionization of electrolytes, theory of acid- base

		indicators, salt hydrolysis and buffer action.
	CO5.	Applying the concepts of Ionic Equilibria to determine the degree of ionization, ionization constant, solubility product and preparation of buffer solution.
BAS213	CO1.	Remembering the concepts of Newtonian Mechanics of general bodies.
	CO2.	Understanding the concepts of rotational dynamics of bodies, gravitation, central forces, Oscillatory motion, Elasticity and fluid motions.
	CO3.	Understanding the frames of references and fundamentals of Special Theory of Relativity.
	CO4.	Applying the concepts of gravitation for understanding the motion of Satellites and planets.
	CO5.	Applying the concept of relativity in understanding the phenomena of time dilation, mass energy equivalence, twin paradox and relativistic addition of velocities.
BAS262	CO1.	Analyzing the heat capacity of calorimeter, enthalpy of ionization and neutralization of acids.
	CO2.	Analyzing the Surface tension and Viscosity of aqueous solutions.
	CO3.	Analyzing the kinetics of first and second order reactions.
	CO4.	Analyzing the integral enthalpy of salt solutions.
	CO5.	Analyzing the chemical kinetics by integrated method.
BAS267	CO1.	Remembering of basic concepts of pendulums like Bar & Kater's pendulums and measuring the value of g.
	CO2.	Understanding of Kinematics of oscillating and bending bodies
	CO3.	Understanding and measuring the random errors in experiments.
	CO4.	Applying time period concepts to determine the acceleration due to gravity, moment of inertia & young modulus using bar, kater's pendulum, mass spring system, fly wheel & cantilever.
	CO5.	Applying Poiseuille's equation to determine coefficient of viscosity & sextant to determine the height of building.
	CO6.	Analyzing the mechanical processes in performing the experiments.
BAS315	CO1.	Understanding simple program modules to implement single numerical methods and algorithms.
	CO2.	Applying to use basic flow controls (if-else, for, while).
	CO3.	Applying Test program output for accuracy using hand calculations and debugging techniques
	CO4.	Applying multiple program modules into larger program packages
	CO5.	Analyzing the generate plots and export this for use in reports and

		presentations.
BAS316	**CO1.**	Understanding of groups, permutation, isomorphism.
	CO2.	Understanding to solve problems with the concept of Vector space to diverse situations in mathematical contexts.
	CO3.	Applying the ability to think critically and principles of algebra and relating them to the number system and analyze them from abstract point of view.
	CO4.	Applying theorems to solve problems in number theory, use of ring theory to cryptography.
	CO5.	Analyzing of various concepts of Ring, Integral Domain and Fields.
BAS319	**CO1.**	Understanding finite differences and interpolation with equal intervals and Unequal Intervals.
	CO2.	Understanding introduction of operators and its properties.
	CO3.	Applying numerical solution of first order differential equation using Eulers, Picards and Runge-Kutta methods and derivative using forward and backward difference interpolation.
	CO4.	Analyzing Lagrange's interpolation formula for unequal intervals.
	CO5.	Evaluating Numerical differentiation and Integration, Trapezoidal Formulae, Simpson's Rule, Weddle rule and Cote's formula.
TMUGE301	**CO1.**	Understanding knowledge of grammar to face competitive exams.
	CO2.	Understanding advance English language by using variety of words i.e. idioms and phrase in variety of sentences in functional context.
	CO3.	Understanding listening for effective communication.
	CO4.	Applying their English grammar knowledge in day to day context.
	CO5.	Applying writing and comprehensive skills in English.
	CO6.	Analyzing Comprehending & enriching their vocabulary through prescribed text.
BHM315	**CO1.**	Understanding the importance of value education in life and method of self-exploration.
	CO2.	Understanding 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration.
	CO3.	Applying right understanding about relationship and physical facilities.
	CO4.	Analyzing harmony in myself, harmony in the family and society, harmony in the nature and existence.
	CO5.	Evaluating human conduct on ethical basis.
TMUGA-302	**CO1.**	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.
	CO2.	Relating the rules of permutation and combination, Fundamental

		Principle of Counting to find the probability.
	CO3.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data.
	CO4.	Correlating the various arithmetic concepts to check sufficiency of data
TMUGS-301	CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings
	CO2.	Understanding and analyzing self and devising a strategy for self growth and development.
	CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.
	CO4.	Utilizing time in the most effective manner and avoiding procrastination.
	CO5.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.
	CO6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.
BAS 314	CO1.	Remembering concepts of Black body radiation, Photoelectric effect and Compton scattering to learn the beginning of quantum mechanics.
	CO2.	Understanding Young's two slit interference of light into the two slit interference of particles (e.g. photon, electron, atom etc.)
	CO3.	Understanding the matter wave and deducing the Schrodinger wave equation.
	CO4.	Understanding the laws of radioactive decay including alpha-, beta- and gamma decay, fission and fusion nuclear process.
	CO5.	Applying the Heisenberg's uncertainty principle to deduce the Size and structure of atomic nucleus and itsrelation with atomic weigh.
	CO6.	Applying the Heisenberg's uncertainty principle to prove the impossibility of an electron being in the nucleus
BCS311	CO1.	Understanding the concept of Database Management System
	CO2.	Applying the commercial relational database system (Oracle).
	CO3.	Applying the relational algebra expressions for queries.
	CO4.	Applying the basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
	CO5.	Analyzing the issues of transaction processing and concurrency control.
BAS367	CO1.	Understanding simple program modules to implement single numerical methods and algorithms.

	CO2.	Applying to use basic flow controls (if-else, for, while).
	CO3.	Applying Test program output for accuracy using hand calculations and debugging techniques
	CO4.	Applying multiple program modules into larger program packages
	CO5.	Analyzing the generate plots and export this for use in reports and presentations.
BAS415	**CO1.**	Remembering linear differential equation of second order.
	CO2.	Understanding finding general solution linear differential equation of second order ordinary simultaneous linear differential equation.
	CO3.	Understanding solution of Pfaffian differential forms/equations and integration in series.
	CO4.	Applying Picards' iteration method uniqueness and existence theorems.
	CO5.	Evaluating conditions using uniqueness and existence theorems.
BAS416	**CO1.**	Understanding the concepts of limit, continuity and differentiability.
	CO2.	Understanding the concepts of sequence, infinite series and various test for convergent.
	CO3.	Understanding the concepts of Riemann integral, uniform convergence and improper integral.
	CO4.	Applying the various test for convergent to test the nature of sequence and series.
	CO5.	Applying the concepts of M-test to test the nature of function of sequences.
BAS432	**CO1.**	Understanding the Mathematical formulation of optimization problems and their solution approach.
	CO2.	Understanding the duality concept in linear programming problem.
	CO3.	Understanding the Mathematical formulation of transportation problems and assignment problems and find their optimality.
	CO4.	Understanding the concept of job sequencing and graphic solution approach of the n machine problem.
	CO5.	Understanding the concept of game theory and their various solution methods.
TMUGE401	**CO1.**	Remembering adequate knowledge of grammar and vocabulary through prescribed text to address competitive exams.
	CO2.	Understanding the value of listening to understand the basic content.
	CO3.	Understanding the usage of English grammar in day to day

		context.
	CO4.	Understating about the skills required in corporate world.
	CO5.	Applying writing and comprehensive skills in English.
	CO6.	Creating a simple proposal and report.
BHM415	CO1.	Understanding the concepts and skills needed to run a business successfully.
	CO2.	Applying the steps of project formulation and market research.
	CO3.	Analyzing the techno economic feasibility of a project.
	CO4.	Analyzing various growth strategies in small scale industry.
	CO5.	Evaluating breakeven point, working capital requirements, and taxes.
TMUGA-402	CO1.	Recognizing the rules of Crypt-arithmetic and relate them to find out the solutions.
	CO2.	Illustrating the different concepts of Height and Distance and Functions.
	CO3.	Employing the concept of higher level reasoning in Clocks, Calendars and Puzzle Problems.
	CO4.	Correlating the various arithmetic and reasoning concepts in checking sufficiency of data.
TMUGS-401	CO1.	Communicating effectively in a variety of public and interpersonal settings.
	CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.
	CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.
	CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.
	CO5.	Handling difficult situations with grace, style, and professionalism.
BAS426	CO1.	Understanding the concept of data analysis, general description, functions, menus and commands.
	CO2.	Understanding the different type of variables as well as computing new variables.
	CO3.	Understanding the concept of Descriptive analysis of data , creating & editing graphs.
	CO4.	Applying the Statistical test (Parametric & non parametric) for independent samples, paired samples.
	CO5.	Evaluating the correlation and regression analysis and cluster sampling.

BAS431	CO1.	Understanding the non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
	CO2.	Applying the discrete and continuous probability distributions to various business problems.
	CO3.	Applying the Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.
	CO4.	Applying the measures of location and measures of dispersion grouped and ungrouped data cases.
	CO5.	Analyzing the results of Bivariate and Multivariate Regression and Correlation Analysis, for forecasting and also perform ANOVA and F-test.
BAS517	CO1.	Understand the concept of the Statistical Quality control techniques and its applications.
	CO2.	Applying the different tools of time series, select the trend equations for the straight and second degree parabola using by least square method.
	CO3.	Applying the different formula of index number and time reversal & factor reversal test, find out index of the data and homogeneity error.
	CO4.	Applying the vital Statistics find out the C.D.R., S.D.R., C.B.R. and ASFR.
	CO5.	Analyzing the methods of measuring seasonal variations, calculate the variation of the various attributes.
BAS518	CO1.	Understanding the concepts of analytic function, Harmonic function, singularities, zeroes, poles, singular point, bilinear transformation and conformal mappings.
	CO2.	Understanding the basic properties of complex integral and their theorems.
	CO3.	Applying the concept of Cauchy's integral theorem, Lioville's theorem, Weierstress theorem and Residue theorem.
	CO4.	Analyzing the Residue of a pole at infinity, limiting point of zero's and poles.
	CO5.	Evaluating the complex integral of the type ($\int_c f(z)dz$), Line integral in the complex plane.
BAS531	CO1.	Understanding the concepts of Euclidean function on Rn.
	CO2.	Understanding the definition of continuity for functions from Rn to Rm.

	CO3.	Applying the method of convergence for sequences in a metric space.
	CO4.	Applying the concepts of compact spaces on the sequences.
	CO5.	Analyzing the geometric meaning of each of the metric space properties.
BAS532	**CO1.**	Understanding the concepts of different methods of finding Laplace transforms and Fourier transforms of different functions.
	CO2.	Applying properties of special functions by their integral representations and symmetries.
	CO3.	Applying Fourier series, term by term differentiation and integration of Fourier series.
	CO4.	Applying the knowledge of L.T, F.T, and Finite Fourier transforms in finding the solutions of differential equations, initial value problems and boundary value problems.
	CO5.	Analyzing the applications of Fourier transforms to boundary value problems.
BAS533	**CO1.**	Understanding basic concept of sets, relation, algebraic structure, Logic gates like countable set, equivalence relation, group, k-maps.
	CO2.	Understanding the basic concept of truth table, recurrence relation like tautology contradiction.
	CO3.	Applying the concept of relation to find out the equivalence relation, one-one, onto & into.
	CO4.	Applying the concept of K-map to convert SOP and POS forms.
	CO5.	Applying the concept of truth table to find out the tautology, contradiction & contingency.
BAS535	**CO1.**	Understanding the Projectile, impulse, impact and laws of impact.
	CO2.	Understanding of the principles of dynamics.
	CO3.	Analyzing the dynamics of rigid body.
	CO4.	Analyzing the path of a projectile is a parabola.
	CO5.	Evaluating the Composition of Simple Harmonic Motion and the differential equation of a central orbit.
BAS536	**CO1.**	Understanding special functions of various engineering problem and to known the application of some basic mathematical methods via all these special functions.
	CO2.	Understanding the applications and the usefulness of these special functions.
	CO3.	Understanding of recurrence formula of the various functions.
	CO4.	Applying the functions of different types of differential equations.
	CO5.	Analyzing the special function of Legendre & Bessel function.

BAS619	CO1.	Understanding the origin of Graph Theory.
	CO2.	Understanding the concepts of a tree, binary tree and spanning tree.
	CO3.	Understanding the basic properties of Planar and dual graphs.
	CO4.	Applying the concepts of cut set in vector space.
	CO5.	Applying the concepts of Geometric dual in Matrix representation of graphs.
BAS632	CO1.	Understanding the concept of the probability, addition law of probability and multiplication law of probability with its applications.
	CO2.	Applying the concept of discrete and continuous random variable to calculate the moment and generating functions.
	CO3.	Analyzing the concept of mathematical expectation, addition and multiplication theorem of Expectation.
	CO4.	Analyzing the M.G.F,C.F and P.D.F of the discrete and continuous distributions.
	CO5.	Evaluating the concept of Probability distributions and its recurrence relation of the distribution.
BAS633	CO1.	Understanding the concept of space curves, fundamental vectors and fundamental planes and their mathematical expressions in n dimensions.
	CO2.	Understanding the concept of surfaces and fundamental forms/metric and relations among them.
	CO3.	Understanding the concept of envelope and ruled surfaces: developable and skew surface, and derive the necessary and sufficient conditions for a surface to be ruled surface.
	CO4.	Understanding of the tensor notations and their algebra, contravariant and covariant tensors and their law of transformation.
	CO5.	Understanding of Christoffel symbols and their tensor law of transformation.
BAS631	CO1.	Understanding the concepts of mathematical models.
	CO2.	Understanding the various mathematical models.
	CO3.	Understanding the concepts of economics based models.
	CO4.	Analyzing the Epidemics based mathematical models.
	CO5.	Analyzing the Mathematical models through difference equations.
BAS634	CO1.	Understanding the fundamental properties of numbers and their various representations in number system.
	CO2.	Understanding the concepts of division algorithm, greatest

		common divisor, least common multiple and Bracket functions.
	CO3.	Understanding the concept of congruence and solution approach of the Diophantine equations.
	CO4.	Understanding the milestone theorems on number theory.
	CO5.	Applying the prime numbers using the concepts of Fermat numbers, Mersenne numbers.