Annexure-II

PAPER-I

MATHEMATICS / MATHEMATICS WITH STATISTICS

(DEGREE STANDARD) **CODE NO: 276**

UNIT I

ALGEBRA AND TRIGONOMETRY:

Theory of Equations: Polynomial equations; Imaginary and irrational roots; Symmetric functions of roots in terms of coefficient; Sum of rth powers of roots; Reciprocal equations; Transformations of equations.

Descrates' rule of signs: Approximate solutions of roots of polynomials by Newton - Raphson Method - Horner's method; Cardan's method of solution of a cubic polynomial.

Summation of Series: Binomial, Exponential and Logarithmic series theorems; Summation of finite series using method of differences - simple problems.

Expansions of sin x, cos x, tan x in terms of x; sin nx, cos nx, tan nx, sin nx, cos nx , tan nx, hyperbolic and inverse hyperbolic functions - simple problems.

Symmetric; Skew Symmetric; Hermitian; Skew Hermitian; Orthogonal and Unitary Matrices; Rank of a matrix; Consistency and solutions of Linear Equations; Cayley Hamilton Theorem; Eigen values; Eigen Vectors; Similar matrices; Diagonalization of a matrix.

Equivalence relations; Groups; subgroups – cyclic groups and properties of cyclic groups - simple problems; Lagrange's theorem; Prime number; Composite number;. decomposition of a composite number as a product of primes uniquely (without proof); divisors of a positive integer n; congurence modulo n; Euler function; highest power of a prime number p contained in n!; Fermat's and Wilson's theroems - simple problems.

Sums of sines and cosines of n angles which are in A.P.; Summation of trigonometric series using telescopic method, C + i S method.

UNIT II

CALCULUS, COORDINATE GEOMETRY OF 2 DIMENSIONS AND DIFFERENTIAL GEOMETRY

nth derivative; Leibnitz's theorem and its applications; Partial differentiation. Total differentials; Jacobians; Maxima and Minima of functions of 2 and 3 independent variables - necessary and sufficient conditions; Lagrange's method – simple problems on these concepts.

Methods of integration; Properties of definite integrals; Reduction formulae - Simple problems.

Conics - Parabola, ellipse, hyperbola and rectangular hyperbola - pole, polar, co-normal points, con-cyclic points, conjugate diameters, asymptotes and conjugate hyperbola.

Curvature; radius of curvature in Cartesian coordinates; polar coordinates; equation of a straight line, circle and conic; radius of curvature in polar coordinates; p-r equations; evolutes; envelopes.

Methods of finding asymptotes of rational algebraic curves with special cases. Beta and Gamma functions, properties and simple problems. Double Integrals; change of order of integration; triple integrals; applications to area, surface are volume.

UNIT III

DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

First order but of higher degree equations – solvable for p, solvable for x, solvable for y, clairaut's form – simple problems.

Second order differential equations with constant coefficients with particular integrals for e^{ax}, x^m, e^{ax} sin mx, e^{ax} cos mx

Second order differential equations with variable coefficients $ax^2\frac{d^2y}{dx^2}+bx\frac{dy}{dx}+cy=q(x)$;

Method of variation of parameters; Total differential equations, simple problems.

Partial Differential equations : Formation of P.D.E by eliminating arbitrary constants and arbitrary functions; complete integral; Singular integral ; general integral; Charpit's method and standard types f(p,q)=0, f(x,p,q)=0, f(y,p,q)=0, f(z,p,q)=0, f(x,p)= f(y,q); Clairaut's form and Lagrange's equations Pp+Qq=R – simple problems.

Laplace transform; inverse Laplace transform(usual types); applications of Laplace transform to solution of first and second order linear differential equations (constant coefficients) and simultaneous linear differential equations – simple problems.

UNIT IV

VECTOR CALCULUS, FOURIER SERIES AND FOURIER TRANSFORMS

Vector Differentiation : Gradient, divergence, curl, directional derivative, unit normal to a surface.

Vector integration: line, surface and volume integrals; theorems of Gauss, Stokes and Green – simple problems.

Fourier Series: Expansions of periodic function of period 2π ; expansion of even and odd functions; half range series.

Fourier Transform: Infinite Fourier transform (Complex form, no derivation); sine and cosine transforms; simple properties of Fourier Transforms; Convolution theorem; Parseval's identity.

UNIT V

ALGEBRAIC STRUCTURES

Groups: Subgroups, cyclic groups and properties of cyclic groups – simple problems; Lagrange's Theorem; Normal subgroups; Homomorphism; Automorphism ; Cayley's Theorem, Permutation groups.

Rings: Definition and examples, Integral domain, homomorphism of rings, Ideals and quotient Rings, Prime ideal and maximum ideal; the field and quotients of an integral domain, Euclidean Rings.

Vector Spaces: Definition and examples, linear dependence and independence, dual spaces, inner product spaces.

Linear Transformations: Algebra of linear transformations, characteristic roots, matrices, canonical forms, triangular forms.

UNIT VI

REAL ANALYSIS

Sets and Functions: Sets and elements; Operations on sets; functions; real valued functions; equivalence; countability; real numbers; least upper bounds.

Sequences of Real Numbers: Definition of a sequence and subsequence; limit of a sequence; convergent sequences; divergent sequences; bounded sequences; monotone sequences; operations on convergent sequences; operations on divergent sequences; limit superior and limit inferior; Cauchy sequences.

Series of Real Numbers: Convergence and divergence; series with non-negative numbers; alternating series; conditional convergence and absolute convergence; tests for absolute convergence; series whose terms form a non-increasing sequence; the class l^2.

Limits and metric spaces: Limit of a function on a real line; metric spaces; limits in metric spaces.

Continuous functions on Metric Spaces: Functions continuous at a point on the real line, reformulation, functions continuous on a metric space, open sets, closed sets, discontinuous functions on the real line.

Connectedness Completeness and compactness: More about open sets, connected sets, bounded sets and totally bounded sets, complete metric spaces, compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.

Calculus: Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral properties of Riemann integral, derivatives, Rolle's theorem, Law of mean, Fundamental theorems of calculus, Taylor's theorem.

Sequences and Series of Functions. Pointwise convergence of sequences of functions, uniform convergence of sequences of functions.

UNIT VII

COMPLEX ANALYSIS

Complex numbers: Point at infinity , Stereographic projection

Analytic functions: Functions of a complex variable , mappings, limits , theorems of limits, continuity, derivatives, differentiation formula, Cauchy-Riemann equations, sufficient conditions Cauchy-Riemann equations in polar form, analytic functions, harmonic functions.

Mappings by elementary functions: linear functions, the function 1/z, linear fractional transformations , the functions $w=z^n$, $w=e^z$, special linear fractional transformations.

Integrals: definite integrals, contours , line integrals, Cauchy-Goursat theorem, Cauchy integral formula, derivatives of analytic functions, maximum moduli of functions.

Series: convergence of sequences and series,Taylor's series, Laurent's series, zero's of analytic functions.

Residues and poles: residues, the residue theorem, the principal part of functions, poles, evaluation of improper real integrals, improper integrals, integrals involving trigonometric functions, definite integrals of trigonometric functions

UNIT VIII

DYNAMICS AND STATICS

DYNAMICS: kinematics of a particle, velocity, acceleration, relative velocity, angular velocity, Newton's laws of motion, equation of motion, rectilinear motion under constant acceleration, simple harmonic motion.

Projectiles : Time of flight, horizontal range, range in an inclined plane. Impulse and impulsive motion, collision of two smooth spheres, direct and oblique impact-simple problems.

Central forces : Central orbit as plane curve, p-r equation of a central orbit, finding law of force and speed for a given central orbit, finding the central orbit for a given law of force.

Moment of inertia : Moment of inertia of simple bodies, theorems of parallel and perpendicular axes, moment of inertia of triangular lamina, circular lamina, circular ring, right circular cone, sphere (hollow and solid).

STATICS: Types of forces, Magnitude and direction of the resultant of the forces acting on a particle, Lami's Theorem, equilibrium of a particle under several coplanar forces, parallel forces, moments, couples-simple problems.

Friction: Laws of friction, angle of friction, equilibrium of a body on a rough inclined plane acted on by several forces, centre of gravity of simple uniform bodies, triangular lamina, rods forming a triangle, trapezium, centre of gravity of a circular arc, elliptic quadrant, solid and hollow hemisphere, solid and hollow cone, catenary-simple problems.

UNIT IX

OPERATIONS RESEARCH

Linear programming – formulation – graphical solution – simplex method

Big-M method – Two-phase method-duality- primal-dual relation – dual simplex method – revised simplex method – Sensitivity analysis. Transportation problem – assignment problem.

Sequencing problem – n jobs through 2 machines – n jobs through 3 machines – two jobs through m machines – n jobs through m machines

PERT and CPM : project network diagram – Critical path (crashing excluded) – PERT computations.

Queuing theory – Basic concepts – Steady state analysis of M/M/1 and M/M/systems with infinite and finite capacities.

Inventory models : Basic concepts - EOQ models : (a) Uniform demand rate infinite production rate with no shortages (b) Uniform demand rate Finite production rate with no shortages – Classical newspaper boy problem with discrete demand – purchase inventory model with one price break.

Game theory : Two-person Zero-sum game with saddle point – without saddle point – dominance – solving 2 x n or m x 2 game by graphical method.

Integer programming : Branch and bound method.

UNIT IX

MATHEMATICAL STATISTICS

Statistics – Definition – functions – applications – complete enumeration – sampling methods – measures of central tendency – measures of dispersion – skewness- kurtosis.

Sample space – Events, Definition of probability (Classical, Statistical & Axiomatic) – Addition and multiplication laws of probability – Independence – Conditional probability

– Bayes theorem – simple problems.

Random Variables (Discrete and continuous), Distribution function – Expected values & moments – Moment generating function – probability generating function – Examples. Characteristic function – Uniqueness and inversion theorems – Cumulants, Chebychev's inequality – Simple problems.

Concepts of bivariate distribution – Correlation : Rank correlation coefficient – Concepts of partial and multiple correlation coefficients – Regression : Method of Least squares for fitting Linear, Quadratic and exponential curves - simple problems.

Standard distributions – Binomial, Hyper geometric, Poission, Normal and Uniform distributions – Geometric, Exponential, Gamma and Beta distributions, Inter-relationship among distributions.

Sampling Theory – sampling distributions – concept of standard error-sampling distribution based on Normal distribution : t, chi-square and F distribution.

Point estimation-concepts of unbiasedness, consistency, efficiency and sufficiency- Cramer Rao inequality-methods of estimation : Maximum likelihood, moments and minimum chi-square and their properties.

Test of Significance-standard error-large sample tests. Exact tests based on Normal, t, chi-square and F distributions with respect to population mean/means, proportion/proportions variances and correlation co-efficient. Theory of attributes – tests of independence of attributes based on contingency tables – goodness of fit tests based on Chi-square.

Analysis of variance : One way, two-way classification – Concepts and problems, interval estimation – confidence intervals for population mean/means, proportion/proportions and variances based on Normal, t, chi-square and F.

Tests of hypothesis : Type I and Type II errors – power of test-Neyman Pearson Lemma – Likelihood ratio tests – concepts of most powerful test –simple problems

PAPER-I
STATISTICS

(UG STANDARD)

CODE NO:274

UNIT I : Uses, Scope and limitation of Statistics, Collection, Classification and Tabulation of data, Diagramatic and Graphical representation, Measures of location, dispersion, Skewness and Kurtosis – Correlation and regression – Curve Fitting – Linear and Quadratic equation by the method of least squares.

UNIT II : Probability - Addition, Multiplication and Baye's Theorems and their application. Tchebychev's inequality. Random variables – Univariate and Bivariate – Probability distributions – Marginal and conditional distributions – Expectations – Moments and cumulants generating functions.

UNIT III : Probability distributions – Binomial, Poisson, Geometric and Hypergeometric. Continuous distributions – Uniform, exponential and normal. Sampling distributions and standard error, student's 't', Chi-square and F statistic – distributions and their applications.

UNIT IV : Estimation – Point estimation – properties of estimates Neyman – Fisher Factorization theorem(without proof) Cramer – Rao inequality, Rao – Blackwell theorem – MLE and method of Moments estimation – Interval estimation – for population mean and variance based on small and large samples.

UNIT V : Tests of Hypothesis – Null and Alternative – Types of errors – Power of test, Neyman – Pearson lemma, UMP and Likelihood ratio tests, Test procedures for large and small samples – Independence of attributes, Chi-square test – Goodness of fit

UNIT VI : Simple random sample – stratified, systematic, Cluster (Single stage) Estimation of mean and variance in SKS – Sample Survey – Organisation – CSO and NSSO – Sampling and Non-Sampling errors.

Analysis of Variance – Principles of design CRD, RBD and LSD – Factorial experiments 2^2, 2^3 and 3^2 (Without confounding) Missing plot techniques.

UNIT VII : Concept of SQC – Control Charts – X, R, p and $\bar{}$ charts Acceptance sampling plan – single and double – OC curves Attributes and Variables plan.

OR Models – Linear Programming problems – Simplex method Dual – Primal, Assignment problems, Net work – CPM and PERT

UNIT VIII : Time series – Different components – Trend and Seasonal Variations – Determination and elimination

UNIT IX : Index Numbers – Construction and uses – Different kinds of simple and weighted index numbers – Reversal tests – construction and use of cost of living index numbers – Birth and death rates – Crude and standard death rates, Fertility rates – Life table construction and uses.

UNIT X : Statistical Computing using Excel – Understanding on the usage of Statistical Packages including SPSS, MINITAB and SAS.

PAPER-I

ECONOMICS / ECONOMICS WITH STATISTICS

(DEGREE STANDARD) **CODE NO.275**

UNIT I

Introduction, Theory of Consumer Behaviour and Theory of Production: Definitions of Economics - Nature and Scope of Economics - Importance and Uses of Micro Economics - Deductive method and Inductive method – Nature of Economic Statics and Economic Dynamics - Economic Laws - Law of Demand - Utility Analysis

- Elasticity of Demand - Consumer's surplus - Indifference Curve Analysis. Theory of Production : Production Function - Factor Combination - Marginal Rate of Substitution – Laws of Returns - Returns to Scale - Producer's Equilibrium- Producer's Surplus - Internal and External Economies and Diseconomies of Scale of Production- Value - Price Determination under different Market Structures - Marginal Productivity Theory of Distribution - Theories of Rent, Wages, Interest and Profit- Causes for Wage difference - Trade Unions and Wages - Cost and Revenue Curves in the Short-run and Long-run - Welfare Economics - Meaning of Social Welfare – Different concepts of Social Welfare.

UNIT II

Introduction to Macro Economics and National Income: Definition of Macro Economics - Nature and Scope of Macro Economics – Difference between Micro and Macro Economics -Stock and flow variables – National Income: Definition – Methods of Measurement of National Income – Difficulties in Measurement of National income

– Uses of National Income estimates - J.B.Says' Law of Market - Keynesian Theory of Employment- Consumption Function and Investment Function -Multiplier -Accelerator - Inflation - Deflation - Trade Cycle.

UNIT III

Monetary Economics and Fiscal Economics: Functions of Money - Classifications of Money- Value of Money - Quantity Theory of Money – Cambridge Version – Fisher and Friedman- Keynesian Critique - Components of Money Supply and Demand – Neutrality of Money - Functions of Commercial Bank and Central Bank - Monetary Policy- Functions of Money Market - Capital Market.

Fiscal Economics: Nature and Scope of Public Finance – Difference between Public and Private Finance – Principle of Maximum Social Advantage - Major Fiscal Functions - Principles of Taxation – Canons of Taxation- Direct and Indirect Taxes- Public Expenditure - Causes and Growth - Revenue Structure - Sources - Incidence and Shifting of Taxation - Public Debt - Sources - Methods of Repayment - Budget – Techniques - Canons – Types of Budget – Balanced, Unbalanced, PBB, Zero Based Budgeting - Fiscal Policy.

UNIT IV

International Trade: Nature of International Trade – Internal and International Trade

- Importance of International Trade - Classical Theory of International Trade - Adam Smith's Absolute Advantage Theory - Ricardo's Comparative Cost Theory - J.S.Mill's Theory of Reciprocal Demand - Hecksher Ohlin Theory of International Trade - Exchange Rate - Balance of Payments Difficulties - Measures - Free Trade vs Protection Policy - International Liquidity - SDR - IMF – IBRD –WTO – UNCTAD. **UNIT V**

History of Economic Thought: Mercantilism – Physiocracy - Adamsmith - Ricardo

- Malthus - Karl Marx - Pigou's Welfare Economics - Schumpeter - Theory of Rational Expectations - Keynes - Economic ideas of Ghandhiji.

UNIT VI

Economics of Development and Economics of Planning: Meaning of Economic Development and Economic Growth - Difference between Growth and Development - Indicators of Development- Features of Indian Economy and Tamil Nadu Economy - Obstacles of Development - Economic and Non-economic Factors - Agriculture - Role and Importance -Low Productivity - Causes - Measures - Green Revolution - Land Reforms - Development in India and Tamil Nadu. Economics of Planning: Meaning and Objectives of Economic Planning – Types of Planning - Five Year Plans in India - Objectives of Indian Plans and Failures & Achievements - Population Policy - Human Resource Development - Employment Schemes - MGNREGS - Poverty Alleviation Programme in India and Tamil Nadu - Rural Industrialisation - SIDCO - DIC - Industrial Estates - Role of Transport.

UNIT VII

Industrial Economics: Industry - Large scale and Small Scale Industries - Development in India and Tamil Nadu - Industrial policy - 1948, 1956, 1991 - Industrial Disputes – Measures to settle Industrial Disputes.

UNIT VIII

Descriptive Statistics: Different data types – Nominal, ordinal, binary and categorical data types - Diagrammatic representation of data – Standard charts, curves diagrams and plots including box plots - Statistical measures – Measures of central tendency – Measures of dispersion - Regression and Correlation coefficients

UNIT IX

Official Statistics and Sampling methods: Official Statistical System in India - Sampling versus Census – preparation of schedules and questionnaires - Probability and nonprobability sampling method including simple random sampling, systematic sampling, stratified sampling, cluster sampling.

UNIT X

Statistical tests for: single proportion, equality of two proportions (large sample) - single mean, equality of two population means (small and large samples) - single variance and equality of two variances - independence of attributes

Paper-II
General Studies
(Degree Standard) (Objective Type)

Subject Code: 003

UNIT-I : GENERAL SCIENCE

(i) Scientific Knowledge and Scientific temper - Power of Reasoning - Rote Learning Vs Conceptual Learning - Science as a tool to understand the past, present and future.

(ii) Nature of Universe - General Scientific Laws – Mechanics - Properties of Matter, Force, Motion and Energy - Everyday application of the basic principles of Mechanics, Electricity and Magnetism, Light, Sound, Heat, Nuclear Physics, Laser, Electronics and Communications.

(iii) Elements and Compounds, Acids, Bases, Salts, Petroleum Products, Fertilizers, Pesticides.

(iv) Main concepts of Life Science, Classification of Living Organisms, Evolution, Genetics, Physiology, Nutrition, Health and Hygiene, Human diseases.

(v) Environment and Ecology.

UNIT-II: CURRENT EVENTS

(i) History - Latest diary of events - National symbols - Profile of States - Eminent personalities and places in news – Sports - Books and authors.

(ii) Polity - Political parties and political system in India - Public awareness and General administration - Welfare oriented Government schemes and their utility, Problems in Public Delivery Systems.

(iii) Geography - Geographical landmarks.

(iv) Economics - Current socio - economic issues.

(v) Science - Latest inventions in Science and Technology.

UNIT- III: GEOGRAPHY OF INDIA

(i) Location – Physical features - Monsoon, rainfall, weather and climate - Water resources - Rivers in India - Soil, minerals and natural resources - Forest and wildlife - Agricultural pattern.

(ii) Transport - Communication.

(iii) Social geography – Population density and distribution - Racial, linguistic groups and major tribes.

(iv) Natural calamity – Disaster Management – Environmental pollution: Reasons and preventive measures – Climate change – Green energy.

UNIT – IV: HISTORY AND CULTURE OF INDIA

(i) Indus valley civilization - Guptas, Delhi Sultans, Mughals and Marathas - Age of Vijayanagaram and Bahmani Kingdoms - South Indian history.

(ii) Change and Continuity in the Socio - Cultural History of India.

(iii) Characteristics of Indian culture, Unity in diversity – Race, language, custom.

(iv) India as a Secular State, Social Harmony.

UNIT-V: INDIAN POLITY

(i) Constitution of India - Preamble to the Constitution - Salient features of the Constitution - Union, State and Union Territory.

(ii) Citizenship, Fundamental rights, Fundamental duties, Directive Principles of State Policy.

(iii) Union Executive, Union legislature – State Executive, State Legislature – Local governments, Panchayat Raj.

(iv) Spirit of Federalism: Centre - State Relationships.

(v) Election - Judiciary in India – Rule of law.

(vi) Corruption in public life – Anti-corruption measures – Lokpal and LokAyukta - Right to Information - Empowerment of women - Consumer protection forums, Human rights charter.

UNIT-VI: INDIAN ECONOMY

(i) Nature of Indian economy – Five year plan models - an assessment – Planning Commission and Niti Ayog.

(ii) Sources of revenue – Reserve Bank of India – Fiscal Policy and Monetary Policy - Finance Commission – Resource sharing between Union and State Governments - Goods and Services Tax.

(iii) Structure of Indian Economy and Employment Generation, Land reforms and Agriculture - Application of Science and Technology in agriculture - Industrial growth - Rural welfare oriented programmes – Social problems – Population, education, health, employment, poverty.

UNIT-VII: INDIAN NATIONAL MOVEMENT

(i) National renaissance – Early uprising against British rule - Indian National Congress - Emergence of leaders – B.R.Ambedkar, Bhagat Singh, Bharathiar, V.O.Chidambaranar, Jawaharlal Nehru, Kamarajar, Mahatma Gandhi, Maulana Abul Kalam Azad, Thanthai Periyar, Rajaji, Subash Chandra Bose and others.

(ii) Different modes of Agitation: Growth of Satyagraha and Militant movements.

(iii) Communalism and partition.

UNIT- VIII : History, Culture, Heritage and Socio - Political Movements in Tamil Nadu

(i) History of Tamil Society, related Archaeological discoveries, Tamil Literature from Sangam age till contemporary times.

(ii) Thirukkural : (a) Significance as a Secular literature

(b) Relevance to Everyday Life

(c) Impact of Thirukkural on Humanity

(d) Thirukkural and Universal Values - Equality, Humanism, etc

(e) Relevance to Socio - Politico - Economic affairs

(f) Philosophical content in Thirukkural

(iii) Role of Tamil Nadu in freedom struggle - Early agitations against British Rule - Role of women in freedom struggle.

(iv) Evolution of 19th and 20th Century Socio-Political movements in Tamil Nadu - Justice Party, Growth of Rationalism - Self Respect]Movement, Dravidian movement and Principles underlying both these movements, Contributions of Thanthai Periyar and Perarignar Anna.

UNIT – IX : Development Administration in Tamil Nadu

(i) Human Development Indicators in Tamil Nadu and a comparative assessment across the Country – Impact of Social Reform movements in the Socio - Economic Development of Tamil Nadu.

(ii) Political parties and Welfare schemes for various sections of people – Rationale behind Reservation Policy and access to Social Resources - Economic trends in Tamil Nadu – Role and impact of social welfare schemes in the Socio - economic development of Tamil Nadu.

(iii) Social Justice and Social Harmony as the Cornerstones of Socio - Economic development.

(iv) Education and Health systems in Tamil Nadu.

(v) Geography of Tamil Nadu and its impact on Economic growth.

(vi) Achievements of Tamil Nadu in various fields.

(vii) e-governance in Tamil Nadu.

UNIT-X: APTITUDE AND MENTAL ABILITY

(i) Simplification – Percentage - Highest Common Factor (HCF) - Lowest Common Multiple (LCM).

(ii) Ratio and Proportion.

(iii) Simple interest - Compound interest - Area - Volume - Time and Work.

(iv) Logical Reasoning - Puzzles-Dice - Visual Reasoning - Alpha numeric Reasoning – Number Series.