

**TAMIL NADU PUBLIC SERVICE COMMISSION**  
**MATHEMATICS**  
**(POST GRADUATE DEGREE STANDARD)**

**CODE: 413**

**UNIT - I. ALGEBRA**

Groups - Subgroups - Normal subgroups - homomorphisms - Isomorphism - Cayley's theorem - Cauchy's theorem - Sylow's theorem - Finite abelian groups - Rings - Euclidean rings - Polynomial rings - Polynomial over the rational field - Polynomials over Commutative rings - Division rings - Frobenius theorem. Field: Finite fields - Wedderburn's theorem, Extension Fields - Roots of Polynomials - Elements of Galois theory - Solvability of radicals - Linear Transformations: Canonical forms - Nilpotent transformations

**UNIT - II REAL ANALYSIS**

Limit, Continuity, types of discontinuities, infinite limits, function of bounded variation, metric spaces. Riemann Integral - Fundamental theorem of calculus - mean value theorem. Riemann - Stieltjes Integral, Infinite series and infinite products, sequences of functions, Fourier series and Fourier Integrals. Outer measure, measurable sets and Lebesgue measures, measurable functions. Littlewood's three principles. Lebesgue Integral of bounded function over a set of finite measure. Integration of a non negative function. General Lebesgue Integral.

**UNIT - III COMPLEX ANALYSIS**

Local properties of analytic functions - Removable singularities Taylor's theorem - Zeros and poles, local mapping - maximum principle - Harmonic functions - Definitions & basic properties - mean value property - Poisson's formula - Schwarz's theorem - reflection principle - power series expansions - Weierstrass's theorem - Taylor's series, Laurent's series.

**UNIT - IV TOPOLOGY**

Topological spaces & continuous functions, metric topology, Connectedness, compactness, countability and separation axiom, Fundamental group and covering spaces.

**UNIT - V FUNCTIONAL ANALYSIS:-**

Fundamentals of normed Linear spaces, bounded Linear maps on Banach spaces, open mapping theorem, converse of Riemann - Lebesgue Lemma, spaces of bounded linear maps, weak and weak convergence, compact linear maps, geometry of Hilbert space, Approximation and optimisation, Bounded operators of Hilbert spaces, spectrum of bounded operators on Hilbert spaces.

## **UNIT- VI DIFFERENTIAL EQUATIONS:-**

Linear differential equations of higher order - Linear dependence and Wronskian basic theory - solutions in power series - Introduction to second order linear equations with ordinary points. Legendre equations and Legendre polynomial, Second order equations with regular singular points, Bessel equations. Partial differential equations; first order, complete Integral, general Integral, singular Integral, Compatible systems of first order equation, Charpit's method. Partial differential equations of second order - Linear and partial equations with constant coefficients Laplace equation - Elementary solutions of Laplace equation.

## **UNIT - VII DIFFERENTIAL GEOMETRY**

Curves, analytic representation, arc length, tangent, osculating plane, Curvature, torsion, formula of Frenet, Contact, natural equations, helices, involutes & evolutes, Elementary theory of surfaces - Analytic representation - first & second fundamental forms, normal - tangent form, developable surfaces, Euler's theorem, Dupin's indicatrices - Conjugate directions, Triply orthogonal system of surface

Fundamental Equations: Gauss, Gauss - Weingarten, Codazzi, Curvilinear, Co-ordinates in space. Geodesics on surfaces Geodesic curvature, Geodesics, Geodesic Coordinates, surfaces of constant curvature, rotation of surfaces of constant curve.

## **UNIT - VIII MECHANICS AND FLUID DYNAMICS:-**

STATICS:- Equilibrium of a system of particles, work and potential energy, friction, common principles of virtual work - stability of equilibrium of forces in three dimensions. DYNAMICS:- Rectilinear motion - motion with constant acceleration motion under gravity - motion along an inclined plane - motion under gravity in a resisting medium Impulsive forces & Impact, Principles of Conservation of Linear momentum, Collision of two smooth spheres - Direct Impact of sphere on a fixed plane - Projectiles - Circular motion of a particle, Central orbits, moment of inertia, motions of a rigid body about a fixed axis - K.E. of rotation - moment of momentum - motion of a circular disc - hoop or a sphere rolling down an inclined plane. Compressible flow; effects of compressibility, Linearized theory, thermodynamical consideration, energy equation, plane shock waves, oblique shockwaves, Prandtl-Meyer expansion - Navier-Stokes equation - dissipation of energy - diffusion of vorticity condition of no slip - steady flow between concentric rotating cylinder - steady viscous flow in tubes of uniform cross section - uniqueness theorem.

## **UNIT IX PROBABILITY & MATHEMATICAL STATISTICS: -**

Probability of an event, Baye's theorem, - Random Variables Discrete & continuous distributions - Expected values & functions. Moment generating function and Characteristics functions - Chebychev's inequality statements of uniqueness theorem & inverse theorems on characteristics functions.

### **STANDARD DISTRIBUTIONS:**

Binomial, Poisson, normal & uniform Sampling distribution of Statistics based on normal distribution - Chi square concept of bivariate distributions, Correlation and regression, Linear prediction, rank Correlation Coefficient, Partial & multiple Correlation. Sample moments & their functions. Notion of sample - statistic - Chi square - distribution, t, Fisher's distributions - distribution of regression coefficients.

### **SIGNIFICANT TESTS:**

Concepts - parametric tests for small & large samples - Chi-square test - test of Independence by contingency table - theory of hypothesis testing - Power function  
- Most powerful tests - Uniformly most powerful test - unbiased tests.

## **UNIT - X OPERATIONS RESEARCH**

Origin & Development of operation's research, Nature & Characteristics of O.R. Models in O.R. General solution methods for O.R. models, uses and limitations of O.R.

**LINEAR PROGRAMMING:** Formulation of problem, graphical solutions, standard form. Definition of basic solution, degenerate solution, simplex method, Definition of artificial variable. **TRANSPORTATION PROBLEM:** Definition, solutions to transportation problem - initial feasible solution - optimal test - Degeneracy - Travelling salesman problem.

**ASSIGNMENT PROBLEM:** Hungarian Method