Income Determination and Distribution: Internal financing, determination of divided policy, implication of inflationary tendencies in determining the dividend policy, valuation and dividednd policy.

Financial management in public sector with special reference to India.

Performance budgeting and principles of financial accounting. Systems of management control.

Part – IV Human Resource Management.

Characteristics and significance of Human Resources – Personnel policies – Manpower, policy and planning – Recruitment and selection Technique – Training and Development – Promotions, and Transfer: Performance Appraisal – Job Evaluation: Wage and Salary Administration; Employee Morals and Motivation. Conflict Management. Management of Change and Development.

Industrial Relations Economy and Society in India: Worker profile and Management Styles in India; Trade Unionism in India. labour Legislation with special reference to Industrial Disputes Act: Payment of Bonus Act: Trade Unins Act: Industrial democracy and Workers participation in Menage indication. Discipline and Grievances Handling in Industry.

19. MATHEMATICS

SECTION- I

Candidates shall answer not more than three questions from each section.

Linear Algebra.

Vector space bases, dimension of finitely generated space. Linear transformations, Rank and nulity of a linear transformation, Cayley Hamilton theorem. Eigenvalues and Eigenvectors.

Matrix of a linear transformation. Row and Column reduction. Echelon form. Equivalence. Congruence and similarity. Reduction to canonical forms.

Orthogonal, symmetrical, skew-symmetrical, unitary, Hermitian and Skew-Hermitian matrices – their eigenvalues, orthogonal and unitary reduction of quadric and Hermitian forms, positive definite quadratic forms. Simultaneous reduction.

Calculus.

Real numbers, limits, continuity, differentiability, Mean-Value theorem, Taylor's theorem, indeterminate forms, Maxima and Minima, Curve Tracing, Asymptotes, Functions of several variables, partial derivatives. Maxima and Minima, Jacobian. Definite and indefinite integrals, double and triple intergrals (techniques only). Application to Beta and Gamma functions. Areas, Volumes, Centre of gravity.

Analytic Geometry of two and three dimensions:

First and second degree equations in two dimensions in Cartesian and polar conrdinates. Plane, Sphere, Paraboloid, Ellipsoid. Hyperboloid of one and two sheets and their elementary properties. Curves in space, curvature and torsion. Frenet's formula.

Differential Equations.

Order and Degree and a differential equation, differential equation of first order and degree, variables separable. Homogeneous, Linear and exact differential equations. Differential equations with constant coefficients. The complementary function and the particular integral of e^{ax}, $\cos^{ax}$, $\sin^{ax}$,x^m, e^{ax} , cosbx, e^{ax}, sin bx.

Vector, Tensor, Statics, Dynamics and Hydrostatics:

(i) Vector Analysis – Vector Algebra, Differential of Vector function of a scalar variable, Gradient, Divergence and Curl in Cartesian Cylindrical and spherical co-ordinates and their physical interpretation. Higher order derivatives. Vector indentities and Vector equations, Gauss and Stocks theorems.

(ii) Tensor Analysis – Definition of Tensor, transformation of co-ordinates, contravariant and covariant tensor. Addition and multiplication of tensors, contraction of tensors, Inner product, fundamental tensor, chirstofel symbols, covariant differentiation. gradient, Curl and divergene in tensor notation.

(iii) Statics – Equilibrium of a system of particles, work and potential energy. Friction, Common catenary. Princlple of Virtual Work stability of equilibrium, Equlibrium of forces in three dimensions

(iv) Dynamics – Degree of freedom and constraints. Rectilinear motion. Simple harmonic motion. Motion in a plane. Projectiles. Constrained motion. Work and energy motion under implusive forces. Kepler's laws. Orbits under central forces. Motion of varying mass. Motion under resistance.

(v) Hydrostatics – Pressure of heavy fluids. Equilibrium of fluids under given system of forces Centre of pressure. Thrust on curved surfaces, Equilibrium and pressure of gases, problems relating to atmosphere.

SECTION- II

Algebra, Real Analysis, Complex Analysis, Partial Differential equations.

Mechanics,, Hydrodynamics, Numerical Analysis. Statistics including probability operational research.

Algebra.

Groups, sub-groups, normal sub-groups, homomorphism of groups, quotient groups. Basic isomorphism theorems. Sylow theorems. Permutation Groups, Cayley's theorem. Rings and Ideals, Principal Ideal domains, unique factorçation domains and Euclidean domains. Field Extensions. Finite fields.

Real Analysis.

Metric spaces, their topology with special reference to Rn sequence in a metric space, Cauchy sequency Completeness, Completion Continuous functions, Uniform Continuity, Properties of Continous function on Compact sets. Riemanh Stieltjes intergral, Improper intergrals and their conditions of existence. Differentiation of functions of several variable, Impicit function theorem, maxima and minima, Absolute and conditional convergence series of real and complex terms, Re-arrangement of series. Uniform convergence, Infinite products, Continuity, differentiability and integrability for series, Multiple intergrals.

Complex Analysis.

Analytic functions, Cauchy's theorem, Cauchy's integral formula, Power series, Taylor's, Singularities, Cauchy's Residue theorem and Contour integration.

Partial Differential Equations.

Formations of partial differential equations. Types of intergrals of partial differential Equations of first order Charpits method. Partial differential equation with constant co-efficient.

Mechanics.

Generalised co-ordinates, Constrainst, Holonomic and Non-holonomic systems, D' Alembert's principle and Lagranges equations. Moment of Inertia, Motion of rigid bodies in two dimension.

Hydrodyanamics.

Equation of continuity, Momentum and energy. Inviscid Flow Theory – Two dimensional motion, streaming motion, Sources and Sinks.

Numerical Analysis.

Transcendental and Polynomial Equations – Methods of tabulation, bisection, regula-talsi, secant, and Newton-Raphson and order of its convergence.

Interpolation and Numerical differentiation – Polynomial interpolation with equal or unequal step sçe. Spline interpolation – Cubic splines. Numerical differentiation formulae with error terms.

Numerical integration – Problems of approximate guardrative guardrature formulae with equispaced arguments. Caussina quardrature convergence.

Ordinary differential equations – Eulers method, Multistep-predictor corrector methods – Adam's and Milne's method, convergence and stability, Runge – Kutta methods.

Probability and Statistics.

1. Statistical methods – Concept of statistical population and readom sample. Collection and presentation of data. Measure of location and dispersion. Moments and shepard's correction comulants. Measures of Skewness and Kurtosis.

Curve fitting by least squares regression, correlation and correlation ratio. Rank correlation, Partial correlation co-efficient and Multiple correlation co-efficient.

2. Probability – Discrete sample space, Events, their union and intersection, etc., Probability – Classical relative frequency and exiomatic approaches. Probability in continuum probability space conditional probability and independence, Basic laws of probability, Probability of combination of events, Bayes theorem, Random variable probability function, Probability density function. Distributions function, Mathematical expectation. Marginal and conditional distributions, Conditional expectation.

3. Probability distributions – Dinomial, Poisson Normal Gamma, Beata. Cauchy, Multinomial, Hypergeometirc, Negative Binomial, Chebychey's Lemma. (Weak) law of large numbers, Central limit theorem for independent and identical varieties, standerd errors, Sampling distribution of T.F and Chi-square and their uses in tests of significance large sample tests for mean and proportion.

Operational Research.

Mathematical Programming – Definition and some elementary properties of convex sets, simplex methods, degeneracy, duality, sensitivity analysis rectangular games and their solutions. Transportation and assignment problems. Kuha Tucker condition for non-linear programming Bellman's optimality principle and some elementary applications of dynamic programming.

Theory of Queues – Analysis of steady-state and transient solution for queueing system with poission arrivals and exponential service time.

Deterministic replacement models, sequencing problems with two machines, n jobs, 3 machines, n jobs (special case) and n machines, 2 jobs.

20. MECHANICAL ENGINEERING

Section- I

Statics – Equalibriuma in three dimension suspension cables, principle of virtual work.

Dynamics – Relative motion coriolis force motion, of a rigid body. Gyrsocpic motion impulse.

Theory of Machines – Higher and lower pairs, inversions, sterign mechanisms. Hooks joint velocity and acceleration of links, interia forces. Cama conjugate action of gearing and interference, gear trains epicyclic gears. Clutches, belt drives, brakes dynamometers, flywheels governors. Balancing of rotating and reciprocating masses and multicylinder engines. Free, forced and damped vibrations for a single degree of freedom. Degrees of freedom critical speed and whirling of shafts.

Mechanics of solids. – Stress and strain in two dimension. Mohr's circle. Theories of failure, deflection of beams. Buckling of columns, combined binding and torsion castiglapo's theorem. Thick cylinders rotating disks Shrink fit. Thermal stresses.

Manufacturing Science – Merchant's theory Taylors equation. Machineability. Unconventional machining methods including EDM, ECM and ultrasonic machining. Use of lesers and plasms. Analysis of forming processes high velocity forming expolsive forming. Surface roughness, gauging comparators, Jigs and Fixtures.

Production Management- Work simplification work sampling value engineering. Line balancing, work station design, storage space requirement. A B C analysis. Economic order, quanitity including finite production rate. Graphical and simplex methods for linear programming; transportation model, elementary quieing theory. Quality control and its uses in product design. Use of X, R, P (Sigma) and C charts. Single sampling plans, operating characteristic curves, average sample sçe Regression analysis.

Section- II

Thermodynamics – Applications of the first and second laws of thermodynamics. Detailed analysis of thermodynamics cycles.

Fluid Machanies. – Continuity, momentum and energy equations. Velocity distribution in laminar and turbulent flow. Dimensional analysis. Boundary layer on a flat plate. A diabatic and isentrophic flow. Mach number.

Heat Transfer – Critical thickness of insulation conduction in the presence of heat sources and sinks. Heat transfer from fines. One dimensional unstuady conducation. Time constant for the mocouples. Momentum and energy equations for boundary layers on a flat plate. Dimensionless number free and forced convection. Boiling and condensation nature of radiant heat. Stefan-Boltz-Mann Law. Configuration factor logarithmic mena temperature difference. Heat exchanger effectiveness and number of transfer units.

Energy Conversion – Combustion phenomenon in C.I and S.I engines carburation and fuel injection Selection of pumbs classification of hydraulic turbines, specific speed. performace of compressor. Analysis of steam and gas turbines. High pressure boilers, Unconventional power systems, including Nuclear power and M H D systems. Utilisation of solar energy.

Environmental Control – Vapour compression absorption, steam jet and air refrigeration systems, properties and characteristics of important refregerants. Use of phychometric chart and comfort chart, estimation of cooling and haring loads. Calculation of supply air state and rate. Air conditioning plants lay-out.