BIHAR MATHEMATICAL SOCIETY
BHAGALPUR

BROCHURE FOR TNP AND TSTM OLYMPIAD

1.Introduction of BMS

The Bihar Mathematical Society (BMS) was established on 01 February 1958 at Bhagalpur. The aim and objective of the society is to provide a common platform for teachers, scientists and research scholars from different parts of the country to exchange ideas for improvement in the field of Mathematics. About 700 National and International Life Members of the society have been contributing substantially to the activities of Bihar Mathematical Society directed towards attainment of its goal. The society has been conducting TSTM Olympiads and TNP do not lead directly to any career benefits; rather, they provide a stimulus to begin a career in science or mathematics, to undertake a lifelong journey into the realms of exciting intellectual challenges. The Olympiads are not merely competitions, they are the meeting places of the brightest young minds of the world. The first Journal of the society was published in 1961.The first conference of the society was held in 1970.

2. Aims & Objectives of the Society:

The aim of the society is to encourage and promote study and research works within India and abroad through the following methods

1. To write, compile and publish journals, books and reports.
2.To invite outstanding scholars to deliver memories and special lectures on their own contributions.
3. To assist, subscribe and to cooperate with any other society having objectives similar to itself.
4.To Establish a forum for the research workers and teachers for exchange of ideas through regular periodic meetings.
5. To remove phobia of mathematics among students and search talented students through TSTM Olympiad and TNP.
6. To equip the students for competitive examinations by training of the young students and to create so much interest for the subject of mathematics.

3. Patron Members:

The Chancellor of the Universities of Bihar shall be the Ex-officio Chief patron. The Vice-Chancellor of each University of Bihar shall be an Ex-officio Patron of Bihar Mathematical Society. The Heads of the Department of Mathematics/Statistics of every University of Bihar shall be an Ex-officio member of the society.

4. Editorial Board

A committee of Editorial board is constituted to write, compile and publish journals, books and reports of Bihar Mathematical Society. The Chief Editor is Prof (Dr.) Balgangadhar Prasad, former Head, University Department of Mathematics, Patna University Patna.

5. Conferences & Seminars:

The first conference was held on 1970 and several seminars and workshops were held since then. The conference is intended to keep abreast of the latest development in the field of mathematics. In order to encourage and inspire the young researchers, the society, during the conference fosters paper presentation, competition and subsequently various prizes to be awarded to the best research papers presented. So far 11 conferences of National and International levels were held in Universities and Colleges in Bihar.

6. Journal of Bihar Mathematical Society

The Bihar Mathematical Society has been publishing its journal named as "Journal of the Bihar Mathematical Society"(JBMS) since 1961.The first Volume of Journal was released by former Vice-Chancellor Prof. B.P Jamuar in 1961. The ISSN No. of the Journal is 0972-8716 .

Introduction of TSTM Olympiad and TNP:-

The Bihar Mathematical Society started organising Talent Search Test in Mathematics (TSTM) since 1993 for school going students of Classes VIII and IX since 2020, the society is organising TSTM Olympiad for classes VI to XII. These examinations help them in developing their skill for future examination like JEE, NEET, BANKING etc. Apart from all benefits, some parts of the examination have majority rewards as well. For the purpose of training and selection of students for the Olympiad contest, all over the Bihar have been designated and each assigned a district Coordinator.

The Society has been conducting Talent Nurture Programme in three levels as Level 1-Class 6 to 12, Level-II. B.Sc & M.Sc and Level III UPSC, NET, GATE, IIT JAM and other competitive examinations.

In order to motivate young students towards Mathematical Olympiads, Director Secondary Education, Dept. Govt. of Bihar vide letter No 276 dated 21.05.2019 an Education Committee was constituted in each district under the chairmanship of District Education Officer. The Primary and Secondary teacher's associations of Bihar also cooperate and give wide publicity among students and ensure participation in TSTM Olympiad.

I. Objectives

The main aim of the TSTM Olympiad and TNP is to locate the talent hidden among young children to motivate them towards rational thinking and prepare them from the earliest stage for the Mathematical contests. Such tests are sure to remove phobia of Mathematics and to make the students academically competent to appear for various competitive examinations. We cultivated the talented

students and honour and inspire the students by awarding prizes. A training programme is conducted by subject experts periodically. The successful candidates in the merit list are called the TSTM and TNP winners.

2. Eligibility

A candidate must be a citizen of India. A regular student of a particular class from any recognized educational institutions of India will be eligible to appear for the TSTM Olympiad and TNP. All candidates are requested to carefully read the Rules of the Examination notified by BMS. The Candidates applying for the examination should ensure that they fulfill all eligibility conditions for admission to Examination. The date of birth and other relevant educational certificates are required to be certified by the principal or head of the institution and submitted only at the time of interview or award function. The maximum age of the applicant is determined from 31.03.2021.

Class	6	7	8	9	10	11	12	TNP Level I	TNP Level II	TNP Level III
Max age(Year)	13	14	15	16	17	18	19	13 to 19	26	35

3. Examination Board:

An examination board is constituted to conduct the examinations of TSTM Olympiad and TNP. An academic president Prof .K C Sinha, Former Principal Patna Science College Patna, academic Secretary, Dr Rakesh Kumar, Principal College of Teacher Education, Bhagalpur and D N Sharma, Controller of Examination including board of examination will look after all academic activities and examinations of BMS.

4. Examination Centres:

Examinations of TSTM & TNP will be conducted at certain specified towns of Bihar. However, it may also be conducted in other towns provided the number of participants in that town is not less than 1000. They will be required to appear at Patna centre or nearby home district. Student of other states would have to appear at Patna centre or any other district of Bihar at their own cost. The Centres and the date of holding the examination as mentioned above are liable to be changed at the discretion of the Society. Candidates admitted to the examination will be informed of the time table and place of examination.

5.Examination Pattern:

It is a subjective type test with a duration of two and a half hours and comprising 10 questions. After the declaration of written examination shortlisted candidates may have to appear for an interview at the Patna centre. There will be no negative marking. The question papers will be set both in Hindi and English.

6. Examination Results:

The result of TSTM Olympiad & TNP are declared on the official website www.bmsbihar.org of Bihar Mathematical Society. Candidates who obtain such minimum qualifying marks in the written Examination as may be fixed by the Society at their discretion, shall be summoned by them for an interview. Marks obtained by the candidates in the written part as well as interview would determine their final ranking. The candidate will be interviewed by a Board who will have before them a record of his career. The object of the interview is to assess the personal suitability of the candidate by a Board.

7. Medals and Certificates:

Top three rank holders in each class will be entitled to be awarded Gold, Silver and Bronze medals along with cash prizes and remaining winners will be entitled to be awarded with certificate of merit and consolation prizes. A Institution/Person actively contributing in organising the TSTM Olympiad & TNP will be awarded by BMS for their co-operation.

8. **Mission of Training Programme:** A training programme is conducted in each district online and offline by subject experts. Those who have completed the foundation course programme successfully would move over to the second stage training programme. Our initiative through this programme is to select top 50 students on the basis of written examination in each level/sub level of TNP from foundation course. The role of the faculty will be to raise relevant questions to keep the students on the right track while leaving them to solve the problems on their own. The winner of TSTM Olympiad are selected for the second stage training for level I. Several tests are held during the training programme. The study material will be provided to all students as per need.

9.Empanelment of Teachers for Training

Resource persons are invited from different institutions across the country for the training programme. They could be Mentors during the contact sessions. With these objectives we are creating a registry of Mathematics Teachers. Those interested to be partner in the endeavour and willing to spend as Mentors every year during the conduct of the programme are welcome to join the Registry in a given format.

10. Programme Scheduled:

1. Last date for submission of application form (TSTM&TNP)- 31May 2021.
2. Foundation course (TSTM&TNP) - 01-30 June 2021
3. Admit card available for examinations (TSTM&TNP)- 01July 2021.
4. Date of Examination (TSTM&TNP)- 25July 2021(11 A.M to 1.30 P.M)
5. Second stage training(TNP)- from August 2021

The e-Admit Card will be made available in the BMS website [www.bmsbihar.org] for downloading by candidates. If a candidate does not receive his e-Admit Card or any other communication regarding his/her

candidature for the examination one week before the commencement of the examination, he/she should at once contact the office of BMS.

11. How to Apply:

Eligible students are invited to directly register and enroll themselves online on official website www.bmsbihar.org of BMS. Detailed instructions for filling up online applications are available on the above mentioned website. Please note that once you register, make sure that you complete the enrollment by making the payment of fees. Interested applicants can fill the application form with all relevant details and submit the application form to the controller of examination of BMS at College of Commerce, Arts and Science, Patna. Students can also approach their subject teacher of their institutions and enroll for the same. Candidates are not required to submit along with their applications any certificate in support of their claims regarding Age, Educational Qualifications, Castes certificate etc. which will be verified at the time of the interview only. The applicants must ensure that while filling their Application Form, they are providing their valid and active E-Mail IDs and mobile number as the society may use electronic mode of communication while contacting them at different stages of examination process. The applicants are advised to check their emails at regular intervals.

12. Application Fee:

Candidates are required to pay fee online on **www.bmsbihar.org**.

The examination fee for individual TSTM Olympiad is Rs 150/ and with training Rs 250/.

The examination fee for individual TNP for foundation course is Rs 250.

Candidates admitted to the second stage training will be required to pay a further fee of Rs. 500/- (Rupees five hundreds only).

A candidate should submit their applications direct to the controller of examination at College of Commerce, Arts and Science Patna or district controller/convener of BMS along with DD drawn on any nationalized bank in favour of **Bihar Mathematical Society** Payable at Patna. Applications without the prescribed Fee shall be summarily rejected. Fee once paid shall not be refunded under any circumstances.

13. Syllabus

The TSTM & TNP Syllabi cater to needs of all boards namely State Board, CBSE and ICSE Board or University. Class wise syllabus can be found on the syllabus page of TSTM Olympiad & TNP. The Syllabus can be obtained on **www.bmsbihar.org**. Candidates are advised to go through the Syllabus published in this Section for the Examination. Syllabi of the papers included in the scheme of TSTM and TNP Examination are given as follows.

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The Syllabus has been designed in accordance with National curriculum framework CBSE, ICSE, State Board and competitive Examinations. The objectives of teaching mathematics at senior school stage intend to help the students to acquare knowledge and critical understanding.

Talent Search Test in Mathematics Olympiad(TSTM) 2021
Talent Nurture Programme (TNP) 2021

Syllabus (Class VI-XII)

Class-VI

Number system, Factors and Multiples, Test of divisibility of numbers, HCF and LCM, Decimals and Fractions, Unitary Method, Elementary Properties of Factorial.

Mensuration, Parameter and Area of simple curve.

Algebraic equations and Expressions, Ratio and Proportion, Percentage and their applications, Symmetry, Making symmetry figures, Reflection and Symmetry.

Geometry, Understanding Elementary Shapes of 2 and 3 dimensions, Line segment, Parallel lines, Polygons, The Triangles and its properties, Quadrilaterals, Circle.

Data Handling.

Class-VII

Elementary properties of real numbers, LCM and HCF, Divisibility rules, Fractions and Decimals, Exponents and Powers, Digit at Unit and tens place in the power of positive integers, Identities, Comparing Quantities, Percentage, Profit and Loss, Simple interest.

Algebraic Equations and Expressions, Law of indices, Exponential Equation.

Visualising of Solid Shapes, Lines and Angles, The Triangle and its Properties, Symmetry, Congruence of Triangles, Quadrilaterals, Polygons, Circles.

Perimeter and Area of Triangle, Rectangle, Parallelogram, Trapezium, Rhombus, Square, Cube and Cuboid.

Data Handling, Arithmetic Mean, Median and Mode.

Simple Trigonometrical identities and their properties.

Basic concept of Probability.

Class-VIII

Properties of real numbers, LCM and HCF of polynomials, Squares and Square Roots, Cubes and Cube Roots, Exponents and Powers, Comparing Quantities.

Percentage, Simple and Compound Interest, Discount and Partnership, Time and Distance, Work and Time.
Algebraic Expressions and Identities, Linear equations and inequations.
Plane, Lines, Angles, Triangles, Congruence, Quadrilaterals, Circles Constructions,
Mensuration, Visualising Solid Shapes, Circle, Cone, Sphere, Cube and Cuboids
Direct and Inverse Proportions, Factorisation, Introduction to Graphs.
Data Handling, Mean, Median, Mode and their Simple Properties.
Basic concept of Probability.
Elementary properties of Sets, Union, Intersection, Venn Diagrams, ordered pairs.

Class-IX

Number Systems, Prime and Composite numbers, Surds and rationalisation of surds, Congruence, Fermat and Wilson theorem, Pythagorean triads, Polynomials, Algebraic expression and identities, Linear Equations in Two Variables, Graph of linear equations
Coordinate Geometry, Coordinate of a point, Distance formula, Section formula, Area of Triangle and Quadrilateral.
Introduction to Euclid's Geometry, Lines and Angles, Triangles, Congruent triangle, Condition of similar triangles, Quadrilaterals, Constructions.
Properties of Polygons, Mensuration, Areas of Parallelograms and Triangles, Heron's Formula, Area of Cyclic quadrilateral, Surface Areas and Volumes of cube, cuboid, cylinder, cone , sphere and Circle.
Introduction of Statistics, Graphical representation of statistical data, Mean, Median of ungrouped data.
Trigonometrical identities and their Properties, Logarithm.
Definition of probability, Terms of probability.

Class-X

Real and Complex Numbers, Polynomials, Pair of Linear Equations in Two Variables, Quadratic Equations and Expressions, Arithmetic Progressions.
Concepts of Coordinate Geometry, Straight Lines, Pair of Straight Lines.
Trigonometrical Ratio, compound angles, Multiple angles and Submultiple angles, Conditional Identities, Height and distance.
Geometry of triangle, Circles, Constructions, Mensuration, Areas related to Circles, Surface Areas and Volumes of Cylinder ,Cone and Sphere.
Introduction of Statistics, Basic concepts of Mean, Median, Mode, Histograms and Ogive.
Probability of Random experiments ,Sample space, Events, simple problem of single events.

Class-XI

Sets and their properties ,Subsets, Power Set, Union, Intersection, Complements of a set, Relations and functions.

Principle of Mathematical Induction, Complex Numbers, Quadratic Equations and Expressions, Partial Fraction, Binomial Theorem, Multinomial theorem, Linear Inequations, Sequences and Series (A.P, G.P and H.P), Combinatorics-Simple Permutations and Combinations, Pigeon Hole Principle (PHP).

Trigonometry, Domain and range of trigonometrical functions, Graphs, Conditional Identities, Trigonometrical Equations, General solutions of trigonometrical equations, Properties Triangles, Logarithms.

Coordinate Geometry of Straight Lines, Conic Sections of Circle, Parabola, Ellipse and Hyperbola.

Statistics (Measure of dispersion), Mean Deviation, Variance and Standard Deviation.

Functions, Limits, Continuity of a Function, Differentiation including Chain Rules, Application of Derivatives, Probability, Addition theorem, Multiplication theorem, Conditional probability.

Introduction to 3-D Geometry of Distance Formulae, Section Formulae, Direction Cosines and Ratios, Plane.

Indefinite Integration, Transformation rule of integration.

Class-XII

Number Theory, congruence modulo m, Relations and Functions, Equivalence Relations, Binary Operation, Inverse Trigonometric Functions.

Matrices and Determinants, Inequalities.

Continuity and Differentiability, Application of Derivatives, Tangent and Normal, Mean value theorem, Maxima and minima Integrals ,Definite integrals. properties of definite integrals, Application of Integrals (area bounded by curve)

Differential Equations of first degree and first order, order and degree, formation of differential equations, application of differential equations.

Vector Algebra, Scalar and Vector products of two and three vectors.

Three dimensional geometry of plane and straight lines, shortest distance between two lines.

Probability of Different type Events, Mutually Exclusive and Independent Events, Addition and Multiplication theorem, Conditional Probability, Bayes' Theorem, Random variable, Expectations, Probability Distribution and Binomial Distribution.

Formation of Linear Programming Problem and their Solution by Graphical Method.

BIHAR MATHEMATICAL SOCIETY
Bhagalpur

Talent Nature Programme(TNP)
Mathematics workshop

SYLLABUS
(B. Sc , M. Sc, UPSC, NET, GATE & IIT JAM)

1.Foundation course training for all applicants of TSTM and TNP.
2.Second stage training only for top 50 students from each level/ sublevel of TNP selected on the basis of examination.
Candidates can download the syllabus on www.bmsbihar@gmal.com.
The syllabus of foundation stage and second stage are mentioned below.

1.Linear Algebra:

Foundation Stage-Vector spaces over R and C, linear dependence and independence, subspaces, bases, dimension, linear transformations, rank and nullity, matrix of a linear transformation.

Matrices, operations of matrix algebra, Kinds of matrices, Transpose adjoint and inverse of the matrix, Product of determinants, row and column reduction, echelon form, Rank and inverse of matrix, Symmetric and skew-symmetric, Hermitian and skew-Hermitian, orthogonal and unitary matrices, congruence and similarity,Solutions of consistent Systems of Linear equation by Cramer's rule.

Second stage-eigenvalues and eigenvectors, characteristic polynomial, Cayley-Hamilton theorem, Matrix representation of linear transformations, Jordan canonical forms, diagonal forms, inner product space, Gram-Schmidt orthonormalization process, self adjoint operator, orthonormal basis, triangular forms, Jordan forms, Quadratic forms, bilinear and quadratic forms.

2.Calculus

Foundation Stage- functions, limits, continuity, differentiability, indeterminate forms ,successive differentiation, partial derivatives, Leibnitz theorem, Total derivatives, , mean value theorem, Tangent and Normal, Curvature, Taylor's theorem with remainders, asymptotes; curvature.

Integration of rational and irrational, Function notion of integral as limit of sum, evaluation of definite integrals, reduction formulae, curve tracing, Areas of curves, Length of curves, Volumes and surface areas of solids of revolution.

Second stage-functions of two or three variables, maxima and minima, Lagrange's method of multipliers, Beta and Gamma functions, Jacobian, Fundamental theorem of integral calculus, double and triple integrals, Dirichlet's and Liouville's theorem, Change of order of integration, Differentiation under sign of integration and integration under sign of integration, Areas, surface area using double integral and volumes using triple integral.

3. Analytic Geometry:

Foundation Stage-Family of straight lines and circles, Standard equation of Parabola, Ellipse and Hyperbola, General equation of second degree, Transformation of rectangular axes.

Cartesian and polar coordinates in three dimensions, second degree equations in three variables, reduction to canonical forms, plane, straight lines, shortest distance between two skew lines.

Second stage- General equation of conics and its reduction to normal form , Equation of tangent and normal at a point of conics, equation of chord of contact, pair of tangents and director circle, Polar equation of conics and their properties.

Sphere, Cone, Cylinder, Paraboloid, Ellipsoid, Hyperboloid of one and two sheets and their properties.S

4. Ordinary Differential Equations:

Foundation Stage-Formulation of differential equations, equations of first order and first degree, integrating factor, Bernoulli's equations, orthogonal trajectory; equations of first order but not of first degree, Clairaut's equation, singular solution, Second and higher order linear equations with constant coefficients, complementary function, particular integral and general solution.

Second stage-Second order linear equations with variable coefficients, Homogeneous Equation Higher order, Variation of Parameter, Euler-Cauchy equation; Method of Laplace transformations for solving ordinary differential equations, Power series, Legendre and Bessel functions and their orthogonal properties, Frobenius method, determination of complete solution, Application to initial value problems for second order linear equations with constant

coefficients, variation and parameters, Sturm-Liouville boundary value problems, Green function.

5. Vector Analysis and Vector Calculus:

Foundation Stage-Scalar and vector fields, Dot and Cross product of two vectors, Scalar triple product of vectors, Vector product of three and four vectors, vector identities and vector equations, Applications of vectors in mechanics.

Second stage-Differentiation of vector field of a scalar variable, Gradient, Divergence and Curl in cartesian and cylindrical coordinates, higher order derivatives, line integrals, surface integrals, Green, Stokes and Gauss theorems.

6. Theory of equations:

Foundation Stage- Division algorithm, greatest common divisors, polynomials, division algorithm derivative, integral, rational, real and complex roots of a polynomial relation between roots and coefficients, repeated roots, elementary symmetric function, fundamental theorem of algebra.

Second stage- Evaluation of symmetric functions of roots of cubic and biquadratic equations, solutions of cubic equation by Cardon's method, solution of biquadratic equations by Euler's method, Descartes rule of signs.

7.Hydrostatics:

Foundation stage-Pressure at a point, Equilibrium of fluids under given system of force. centre of pressure, Equilibrium of floating bodies.

8.Topology:

Foundation Stage-Metric spaces and their basic properties, open sphere, open set, neighborhoods, closed set, accumulation point, closure and interior, convergence of sequence in a metric space and their properties, Cauchy sequence and complete metric space, continuous mappings, Compactness and their basic properties , finite intersection property, Normed linear space.

Second stage- Definition and examples of topological space, closed set, closure, Dense subset, Derived set, Bases and sub-spaces, Continuity of functions and homeomorphism, separation axiom T_0, T_1, T_2 spaces their characteristics and basic properties, connectedness.

9.Set Theory

Foundation Stage- Set, Subsets, Power Set, Algebra of Sets, De Morgan's Laws, Cartesian Product of sets, relation, equivalence relation, Definition and examples of partial and total order relation, Countable and uncountable sets, Countability of rational, Real And algebraic number system, Countability of unions.

Second Stage-Equivalence relation induced by a partition of a set, Fundamental theorem of equivalence relation, Composition and factorization of mapping, set mapping, countability of rational, real and algebraic number system.

10.Probability

Foundation stage-Event, Probability of an event, sample space, probabilities a finite sample space, Mutually exclusively events and complementary events, independent events, conditional probability, multiplication theorem, theorem of total probability, Bayes theorem and independents of events.

Second stage-Random variables and their probability functions. Mathematical expectation and moment of a random variable, Mean absolute deviation, variance, standard variation, Chebyshev's theorems for a probability distribution and frequency distribution of measurements.

1.Algebra:

Foundation Stage- Binary operation, Notions of group, Abelian group with examples, groups, subgroups, cyclic groups, cosets, Lagrange's theorem, normal subgroups, quotient groups, homomorphism of groups, automorphism, basic isomorphism theorems, Centre, Normalizer, Conjugacy, class equation, Commutator and commutator sub group

Rings, integral domains, subrings and ideals, integral domain, division ring, polynomial ring, field and their examples.

Second stage-Permutation groups, Cayley's theorem, Sylow theorems, homomorphisms of rings, Isomorphism, Kernel of a ring homomorphism,

quotient rings, Fundamental theorem of homomorphism rings, imbedding of a ring and integral domain in a field, characteristics of a field, polynomials over commutative ring, unique factorization domain, principal ideal domains, Euclidean domain, polynomial rings, finite fields, field extension, Galois theorem.

2. Real Analysis:

Foundation Stage-Real number system as an ordered field with least upper bound property, Dedekind's theory of real numbers, Canter's construction of real numbers, properties of real numbers sequences, limit of a sequence, Cauchy sequence, completeness of real line, Monotonic function ,Continuity and uniform continuity of functions, properties of continuous functions on compact sets.

Infinite series and their convergence, Comparison test, Cauchy root test, Raabe's test, Cauchy condensation test, Integral test, Leibnitz's test, Gauss Test, Kummer's test, de Morgan and Bertrand's test, absolute convergence and rearrangement of series, Pringsheim's theorem, Cauchy's multiplication of series and its convergence.

Second stage-Riemann sum and Riemann integral, Improper integral, convergence of an improper integral, comparison tests, fundamental theorems of integral calculus. Uniform convergence of sequence and series of functions, Wire strass M-test, uniform convergence and continuity, Dini's test, Abel's test, Dirichlet's Test, Uniform convergence and integration, Uniform convergence and differentiation, Weierstrass sequence and series of functions and their pointwise convergence, continuity, differentiability and integrability for sequences and series of functions, Inverse and Implicit theorems, maxima and minima, Ascoli-Arzela theorem, Contraction mapping principle.

3. Complex Analysis:

Foundation Stage-Algebra of complex numbers**,** Continuity, Differentiability, Analytic functions, Cauchy-Riemann equations, Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Morera's theorem, Taylor's series, Laurent's series.

Second stage-Calculus of residue, singularities; Isolated singularity, meromorphic function, Argument Principle, Schwartz lemma, open mapping theorem, Cauchy's residue theorem, Rouche's theorem, fundamental theorem of algebra, contour integration, power series representation of an analytic function, Mobius transformation, Conformal mappings.

4. Operation Research:

Foundation Stage-Linear programming problems, basic solution, basic feasible solution and optimal solution; graphical method, convex set, simplex method of solutions.

Second stage-Revised simplex method, Infeasible and unbounded linear programming problem, Big-M Method, Two phase method, duality, transportation , assignment problems, Game theory, two person-zero sum games with mixed strategies, Sequencing, Replacement model, Kuhn-Tucker condition for constrained optimization ,Wolfe's and Beale's methods, Queuing theory, Poisson probability law, Distribution of inter arrival time, Distribution of time between successive arrivals.

5. Partial differential equations:

Foundation stage-Family of surfaces in three dimensions and formulation of partial differential equations, solution of quasi-linear partial differential equations of the first order.

Second stage- Linear partial differential equations of the second order with constant coefficients, Lagrange's and Charpit's methods for solving first order solving PDEs, Cauchy's problem for first order PDEs, Monge's Method ,Method of separation of variables for Laplace, Heat and wave equations.

6. Numerical Analysis:

Foundation Stage-Finite differences, Newton's forward and backward interpolation, Lagrange's interpolation, Hermite and spline interpolation, Numerical methods, solution of algebraic and transcendental equations of one variable by bisection, Secant method, iteration method, order of convergence, Regula-Falsi method, Newton-Raphson methods.

Second stage-Solution of system of linear equations by Gaussian elimination and Gauss-Jordan (direct), Gauss-Seidel (iterative), Relaxation Method, Numerical integration, Trapezoidal rule, Simpson's rules, Gaussian quadrature formula. Numerical solution of ordinary differential equations, Euler, Modified Euler and Runge Kutta-methods, Picard's method .

7. Fluid Dynamics:

Foundation stage- Lagrangian and Eulerian methods, Equation of continuity, Euler's equation of motion for inviscid flow, Stream-lines, path of a particle, Potential flow, irrotational and rotational motions, Sources and sinks, vortex motion.

Second Stage-Navier-Stokes equation for a viscous fluid, Bernoulli's theorem, equation of motion by flux method, equation referred to moving axis, impulsive actions.

8.Functional Analysis:

Foundation Stage- Complex linear space, normed linear space, completion of a normed linear space, quotient space of normed linear space, Banach space and their definition, properties and examples.

Second stage-Inner product space and Hilbert space and their properties and examples, Orthonormal bases, projection theorem, Riesz representation theorem, spectral theorems for self adjoint operators, Cauchy Schwartz inequality, parallelogram law and polarization identity, Hahn-Banach theorem on real linear space, Open mapping theorem and closed graph theorems, Principle of uniform boundness.

9. Statistics

Mean, Variance and standard deviation of random variables, Binomial, Poisson and Normal distributions, Correlation and linear regressions.

10.Mechanics

Foundation course- Coplanar force of system, Condition for equilibrium of particles , Equipollent force system, Reduction of a force system to a force and a couple, Work and Energy principle, Equation of the resultant Principle of virtual work in two dimension

Uniformly accelerated motion, Dynamics S.H.M. Simple Pendulum, Elastics String and springs, Hook's Law, vertical and horizontal vibrations of a particle attached to an elastic strings, Components of velocities and acceleration, Cartesian, radial and transverse, tangential and normal.

Second Stage- stable equilibrium, Energy test for stability, Catenary Poinsot's central axis pitch, Null lines, Euler's theorem on displacement of a rigid body with one fixed point, displacement of a rigid body, Motion about a fixed point, angular velocity and linear velocity, General motion of a body, Principle of linear momentum, angular momentum and energy for a rigid body, D'Alembert's principle of general equations of motions of rigid body.

Projectile motion in non-resisted medium , Motion of a particle under central force, Differential equation of central orbit in polar and pedal forms Newton's law of gravitation and planetary orbit, Kepler's laws, Moment of inertia, Parallel axes and perpendicular axes theorem.

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