

SAINATH UNIVERSITY

B.SC MATHS SYLLABUS

1ST YEAR

PAPER	COURSE CODE	SUBJECT'S NAME
1	DR1 K1	HINDI
2	DR3 B1	ENGLISH
3	DNM 1A	CALCULUS
4	DNM 1B	CLASSICAL ALGEBRA
5	DNM 1C	STATISTICS

2ND YEAR

PAPER	COURSE CODE	SUBJECT'S NAME
1	DR1 K2	HINDI
2	DR3 B2	ENGLISH
3	DNM 2A	ANALYTICAL GEOMETRY 3D AND VECTOR CALCULUS
4	DNM 2B	MODERN ALGEBRA
5	DNM 2C	NUMERICAL ANALYSIS

3RD YEAR

PAPER	COURSE CODE	SUBJECT'S NAME
1	DNM 3A	OPERATIONS RESEARCH
2	DNM 3B	ANALYSIS
3	DNM 3C	MECHANICS
4	DNM 3D	ASTRONOMY
5	DNM 3E	DISCRETE MATHEMATICS

CALCULUS – DNM 1A**Unit I**

Curvature – radius of curvature – Cartesian and polar – centre of curvature – Involute and evolute – Asymptotes in Cartesian co-ordinates – Multiple points – double points.

Unit II

Evaluation of double and triple integrals – jacobians, change of variables.

Unit III

First order differential: equations of higher degree – solvable for p , x and y – Clairaut's form/linear differential equations of second order – particular integrals for functions of the form, X_n , e^{ax} , e^{bx} ($f(x)$). Second order differential equations with variable coefficients.

Unit IV

Laplace transform-Inverse transform – Properties – Solving differential equations. Simultaneous equations of first order using Laplace transform.

Unit V

Partial differential equations of first order – formation – different kinds of solution – four standard forms – Lagrange's method.

Books:

1. Calculus 1,2 & 3, T.K. Manickavachagom pillai & others.
2. Calculus 1&2, S. Arumugam and Isaac.

CLASSICAL ALGEBRA – DNM 1B**Unit I**

Theory of Equations: Every equation $f(x) = 0$ of n th degree has ' n ' roots. Symmetric functions of the roots in terms of the coefficients – sum of the r th powers of the roots – Newton's theorem –Descartes rule of sign – Rolle's theorem.

Unit II

Reciprocal Equations – Transformation of equations – solution of cubic and biquadratic equation –Cardon's and Ferrari's methods – Approximate solution of numerical equations- Netwon's and Horner's methods.

Unit III

Sequences and series: Sequences – limits, bounded, monotonic, convergent, oscillatory and divergent sequence – algebra of limits – subsequences – Cauchy sequences in \mathbb{R} and Cauchy's general principle of convergence.

Unit IV

Series – convergence, divergence – geometric, harmonic, exponential, binomial and logarithmic series –Cauchy’s general principle of convergence – comparison test – tests of convergence of positive termed series – Kummer’s test, ratio test, Raabe’s test, Cauchy’s root test, Cauchy’s condensation test. Summation of series using exponential, binomial and logarithmic series.

Books for reference

1. Sequences and series, S. Arumugam & Others
2. Algebra – Vol. I, T.K. Manickavachagom pillai & Others
3. Real Analysis – Vol.I, K. Chandrasekara Rao & K.S. Narayanan
4. Infinite series, Bromwich.

STATISTICS – DNM 1C

Unit I

Correlation – Karl Pearson’s coefficient of Correlation, Lines of Regression – Regression coefficients –Rank correlation.

Unit II

Probability – Definition – application of addition and multiplication, theorems – conditional, Probability – Mathematical Expectations – Moment generating function – special distributions, (Binomial distribution, Poisson distribution, Normal distribution – properties).

Unit –III

Association of attributes – Coefficient of association – consistency – time series – Definition –Components of a time series – Seasonal and cyclic variations.

Unit –IV

Sampling – definition – large samples. Small samples – Population with one sample and population with two samples – students – t-test-applications – chi – square test and goodness of fit – applications.

Unit – V

Index numbers – Types of Index Numbers – Tests – Unit test, Commodity reversal test, time reversal test, factor reaversal test – Chain index numbers – cost of living index- Interpolation – finite differences operators ----- - Newton’s forward, backward interpolation formulae, Lagrange’s formula.

Books:

1. Statistics: S. Arumugam & others
2. Statistics: D.C. Saucheti & Kapoor
3. Statistics: Mangaladas & Others
4. Statistics: T. Sankaranarayana & Others.

B.SC MATHS II YEAR SYLLABUS

ANALYTICAL GEOMETRY 3D AND VECTOR CALCULUS – DNM 2A

Unit I

Rectangular Cartesian Coordinates in space – Distance formula – Direction ratio and cosines – Angle between lines – simple problems. Plane – different forms of equation – angle between two planes – perpendicular distance from a point on a plane – projection of a line or a point on a plane.

Unit II

Lines – symmetrical form – plane and a straight line – The perpendicular from a point on a line – Coplanar lines – shortest distance between two skew lines and its equation. Sphere – Different forms of equations- plane section – the circle and its radius and centre – tangent plane – condition for tangency – touching spheres – common tangent plane – point of orthogonality of intersection of two spheres.

Unit III

Vector differentiation – Gradient, Divergence and Curl operators – solenoidal and irrotational fields formulas involving the Laplace operator.

Unit IV

Double and triple integrals – Jacobian – change of variables – Vector integration – single scalar variables – line, surface and volume integrals.

Unit V

Gauss's, Stokes's and Green's theorems – statements and verification only.

Books for reference

1. Analytical Geometry of 3D-Part II, Manickavachagom Pillai
2. Analytical Geometry of 3D & Vector Calculus – P. Duraipandian & Others
3. Analytical Geometry of 3D & Vector Calculus – S. Arumugam & Others
4. Vector Analysis, K. Viswanathan.

MODERN ALGEBRA – DNM 2B

Unit I

Sets – functions – relations – partitions – composition of functions – groups – subgroups – cyclic groups.

Unit II

Normal subgroups – cosets – Lagrange's theorem – Quotient groups – Homomorphism – Kernel – Cayley's theorem – Fundamental theorem of homomorphism.

Unit III

Rings – types – subring – ordered integral domain – ideals – Quotient rings – P.I.D. – Homomorphism of rings – fundamental theorem of homomorphism – Euclidean rings.

Unit IV

Definition and example of vector spaces – subspaces – sum and direct sum of subspaces – linear span, linear dependence, independence and their basic properties – Basis – finite dimensional vector spaces – dimension of sums of subspaces – Quotient space and its dimension.

Unit V

Linear transformation and their representation as matrices – Algebra of linear transformations – dual spaces – Eigen values & Eigen vectors of a linear transformation – inner product spaces – Schwartz inequality – orthogonal sets and basis – Gram Schmidt orthogonalization process.

Reference books

1. Modern Algebra, S. Arumugam and Issac
2. Modern Algebra, Vasistha
3. Topics in Algebra, I.N. Herstein, Vikas Publishers

NUMERICAL ANALYSIS – DNM 2C

Unit I

Finite differences – difference table – operators E, Δ and ∇ – Relations between these operators – Factorial notation – Expressing a given polynomial in factorial notation – Difference equation – Linear difference equations – Homogeneous linear difference equation with constant coefficients.

Unit II

Interpolation using finite differences – Newton – Gregory formula for forward interpolation – Divided differences – Properties – Newton's formula for unequal intervals – Lagrange's formula – Relation between ordinary differences and divided differences – inverse interpolation.

Unit III

Numerical differentiation and integration – General Quadrature formula for equidistant ordinates – Trapezoidal Rule – Simpson's one third rule – Simpson's three eighth rule – Waddle's rule – Cote's method.

Unit IV

Numerical solution of ordinary differential equations of first and second orders – Piccard's method. Euler's method and modified Euler's method – Taylor's series method – Milne's method – Runge – Kutta method of order 2 and 4 – Solution of algebraic and transcendental equations. Finding the initial approximate value of the root – Iteration method – Newton Raphson's method.

Unit V

Simultaneous linear algebraic equations – Different methods of obtaining the solution – The elimination method by Gauss – Jordan method – Grout's method – Method of factorization .

Books:

Calculus of finite differences and Numerical Analysis, P.P. Gupta & G.S. Malik, Krishna Prakasham
Mardin, Mecrutt.

B.SC MATHS III YEAR SYLLABUS

OPERATIONS RESEARCH – DNM 3A

Unit - I

Linear programming problem – Mathematical formulation – Graphical method of solution – simplex method – The big M method (Charnes method of penalties) – Two phase simplex method – Duality – Dual simplex method – integer programming.

Unit – II

Transportation problem – mathematical formulation – North –west corner rule – Vogel's approximation method (unit penalty method) – method of matrix minima – optimality test – maximization – Assignment problem – mathematical formulation – method of solution – maximization of the effective matrix.

Unit III

Sequencing problem – introduction – n jobs and two machines – n jobs and three machines – two jobs and n machines – graphical method – inventory models: types of inventory models: Deterministic:

- 1) Uniform rate of demand, infinite rate of production and no shortage
- 2) Uniform rate of demand, finite rate of replenishment and no shortage
- 3) Uniform rate of demand, instantaneous production with shortages
- 4) Uniform rate of demand, instantaneous production with shortage and fixed time.

Unit IV

Probabilistic Models: Newspaper boy problem – discrete and continuous type cases- Inventory models with one price break.

Queueing Theory: General concept and definitions – classification of queues – Poisson process, properties of poisson process – models: 1) (M/M/1) : (∞ /FCFS), 2)(M/M/1): (N/FCFS), 3)(μ /M/S):(∞ /FCFS).

Unit V

Network Analysis: Drawing network diagram – Critical path method – labelling method – concept of slack and floats on network – PERT – Algorithm for PERT – Differences in PERT and CPM. Resource Analysis in Network Scheduling : Project cost – Crashing cost – Time-cost optimization algorithm – Resource allocation and scheduling.

Books for Reference:

1. Operations Research: Kantiswarup, P.K. Gupta and Man Mohan.
2. Operations Research: P.K. Gupta, D.S. Hira.
3. Operations Research: V.K. Kapoor
4. Operations Research: S.D. Sharma
5. Operations Research: Mangaladoss.

ANALYSIS- DNM 3B

Unit I

Metric spaces – open sets – Interior of a set – closed sets – closure – completeness – Cantor's intersections theorem – Baire – Category Theorem.

Unit II

Continuity of functions – Continuity of compositions of functions – Equivalent conditions for continuity – Algebra of continuous functions – homeomorphism – uniform continuity – discontinuities – connectedness – connected subsets of \mathbb{R} – Connectedness and continuity – continuous image of a connected set is connected – intermediate value theorem.

Unit III

Compactness – open cover – compact metric spaces – Heine Borel theorem. Compactness and continuity – continuous image of compact metric space is compact – Continuous function on a compact metric space is uniformly continuous – Equivalent forms of compactness – Every compact metric space is totally bounded – Bolzano – Weierstrass property – sequentially compact metric space.

Unit IV

Algebra of complex numbers – circles and straight lines – regions in the complex plane – Analytic functions – Cauchy – Riemann equations – Harmonic functions – Bilinear transformation – translation, rotation, inversion – Cross-ratio – Fixed points – Special bilinear transformations.

Unit V

Complex Integration – Cauchy's integral theorem – Its extension – Cauchy's integral formula – Morera's theorem – Liouville's theorem – fundamental theorem of algebra – Taylor's series – Laurent's series – Singularities. Residues – Residue Theorem – Evaluation of definite integrals of the following types.

$$\int_0^{2\pi} F(\cos x, \sin x) dx \quad \int_{-\infty}^{\infty} f(x) dx$$

Books for reference:

1. Modern Analysis – Arumugam and Issac.
2. Real Analysis – Vol. III – K. Chandrasekhara Rao and K.S. Narayanan, S. Viswanathan Publisher.
3. Complex Analysis – Narayanan & Manicavachagam Pillai
4. Complex Analysis – S. Arumugam & Issac.
5. Complex Analysis – P. Durai Pandian
6. Complex Analysis – Karunakaran, Narosa Publishers.

MECHANICS – DNM 3C

Unit I

Forces acting at a point – parallelogram of forces – triangle of forces – Lami's theorem, Parallel forces and moments – Couples – Equilibrium of three forces acting on a rigid body – Coplanar forces – Reduction of any number of Coplanar forces theorems. General conditions of equilibrium of a system of Coplanar forces.

Unit II

Friction – Laws of friction – Equilibrium of a particle (i) on a rough inclined plane. (ii) under a force parallel to the plane (iii) under any force – Equilibrium of strings –

Equation of the common catenary – Tension at any point – Geometrical properties of common catenary – uniform chain under the action of gravity – Suspension bridge.

Unit III

Dynamics – Projectiles – Equation of path, Range etc – Range on an inclined plane – Motion on an inclined plane. Impulsive forces – Collision of elastic bodies – Laws of impact – direct and oblique impact – Impact on a fixed plane.

Unit IV

Simple harmonic motion in a straight line – Geometrical representation – Composition of SHM's of the same period in the same line and along two perpendicular directions – Particles suspended by spring – S.H.M. on a curve – Simple pendulum – Simple Equivalent pendulum – The seconds pendulum.

Unit V

Motion under the action of Central forces – velocity and acceleration in polar coordinates – Differential equation of central orbit – Pedal equation of central orbit – Apses – Apsidal distances – Inverse square law.

Books for Reference:

1. Statics and Dynamics: S. Narayanan
2. Statics and Dynamics : M.K. Cenkatarman
3. Statics: Manickavachagom pillai
4. Dynamics: Duraipandian.

ASTRONOMY – DNM 3D

Unit I

Spherical Trigonometry (only formulae) celestial sphere – four systems of coordinates – Diurnal motion – Zones of the earth – Perpetual day and night – Terrestrial longitude and latitude – International date line.

Unit II

Dip of horizon – effects – Twilight – shortest twilight.

Unit III

Refraction – Tangent formula – Cassini's formula – Effects – Horizontal refraction – Geocentric parallax.

Unit IV

Kepler's laws – verification – Newton's deductions – Anomalies – Planets – Inferior and superior planet – Bode's law – Elongation – Sidereal period – Synodic period – Phase of the planet – Stationary positions of a planet.

Unit V

Moon – Phase – sidereal and synodic period – elongation – Metonic cycle – golden number – Eclipses – Lunar and solar eclipses – conditions – Synodic period of the nodes – Ecliptic limits – Maximum and minimum number of eclipses near a node and in a year – Saros – Lunar and solar eclipses compared.

Books:

1. Astronomy: S. Kumaravelu & Susheela Kumaravelu.
2. Astronomy: G.V. Ramachandran
3. Astronomy: K. Subramanian and L.V. Subramanian

DISCRETE MATHEMATICS – DNM 3E**Unit I**

Definition and examples of graphs – degrees – sub graphs – isomorphism – Ramsey numbers – independent sets and coverings – intersection graphs and line graphs – matrices – operations in graphs – degree sequences, graphic sequences.

Unit II

Walks – trails and paths – connectedness and components – blocks – connectivity – Eulerian graphs – Hamiltonian graphs – trees – characterization of trees – centre of a tree.

Unit III

Planar graph and their properties – characterization of planar graphs – thickness – crossing and outerplanarity – Chromatic number – chromatic index – five colour theorem – four colour problem – chromatic polynomials – Directed graphs and basic properties – paths and connections in digraphs – Digraphs and matrices – tournaments.

Unit IV

Permutations – ordered selections – unordered selections – further remarks on binomial theorem – Pairings within a set – pairings between sets, – an optimal assignment problem.

Unit V

Recurrence relations – Fibonacci type relations – Using generating functions – miscellaneous methods – The inclusion exclusion principle and rook polynomials.

Text Books:

1. Invitation to graph theory, S. Arumugam and S. Ramachandran, Scitech Publications.
2. A first course in combinatorial mathematics, Ian Anderson (Oxford applied Math. Series)

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