MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI

Integrated M.Sc Mathematics (CBCS)

(For those who join the course from the Academic year 2017-18)

REGULATIONS, SCHEME OF EXAMINATIONS AND SYLLABUS

A. Regulations

A1 : Course objectives:

➢ The idea of the course is to attract the young talents to Mathematics keeping in line with the policy of the Government of India to promote education in pure sciences. The syllabus is framed keeping this goal in mind.

➢ Elective subjects in the fourth and fifth years are planned to suit competitive examinations like NET and SLET.

➢ Students undergoing this course will have the opportunity of choosing research / teaching at leading research institutions or a career in corporate sectors.

➢ To enable the students to have a thorough exposure to the different branches of Mathematics so as to gain a comprehensive knowledge of Mathematics.

➢ To cultivate logical thinking and analytical skills which sharpens their concentration and provides patience to grapple with life outside the campus.

A2 : Duration of the Course :

The duration of the course is 5 years under choice based credit system. The minimum number of credits to be earned during the first three years of the course is 140. Students who have passed all the papers for the first three years of the course will be given a B.Sc Degree at the end of the third year. Students who have passed all the papers for the fourth and fifth years of the course will be given M.Sc Degree. Students have an option to exit from the program with a B.Sc Degree alone.

Students who have passed all the papers for the first three years of the course alone will be permitted to continue the course in the 4th year. Students who are not successful at the end of the third year will not be permitted to continue or rejoin the course in future under the integrated mode. The minimum number of credits to be earned during the last two years of the course to get M.Sc Degree is 90.

A3 : Eligibility norms for admission:

Those who seek admission to Integrated M.Sc. Mathematics Degree Course must have passed the Higher Secondary Examinations (+ 2) conducted by the Board of Higher Secondary Examination, Tamil Nadu with the subjects Mathematics, Physics and Chemistry or

an equivalent course of study with 60% of marks in Mathematics (55% for SC/ST/SCA applicants)

A4: Mode of Admission: An entrance examination (objective type questions) will be conducted for eligible applicants. The merit list will be prepared for a total of 100 marks with 50 marks for entrance examination and 50 marks for mathematics paper in + 2. Then admission will be based on merit and reservation policy of the Government of Tamil Nadu.

B. Scheme of examinations :

Each paper is for 100 marks with Internal 25 marks and External 75 marks.

For Semesters I – VI, the internal assessment comprises of 2 components – 20 marks for written test (average of the best two of 3 tests) and 5 marks for Assignment.

For Semesters VII – X, the internal assessment comprises of 3 components -15 marks for written test (average of the best two of 3 tests), 5 marks for Seminar and 5 marks for Assignment.

The semester Question paper pattern for external examination is as follows :

Section A - 10 x 1 = 10 (Objective type questions)

Section B - 5 x 5 = 25 (Internal choice questions)

Section C - 5 x 8 = 40 (Internal choice questions)

The duration of the examination is 3 hours. Passing minimum in the external examination – 38 out of 75 (50 %). Passing minimum in the aggregate (internal and external marks put together) – 50 out of 100 (50 %). No passing minimum for the internal examinations.

Examination, evaluation and classification will be made as per the rules and regulations of the University in force.

C. SYLLABUS

The syllabi for Part – I (Language) , Part – II (English) and Part IV (Environmental Studies and Value based education etc) are as in B.Sc. Mathematics Program of affiliated Colleges.

The structure and syllabi of other subjects are as below :

	Part	Su	Sub.	Subject Title	Hrs/	L	T	P	Cre

Sem (1)	I/II/III /IV/V (2)	b. No (3)	Status (4)	(5)	wee k (6)	Hrs/ wee k (7)	Hrs/ week (8)	Hrs/ wee k (9)	dits (10)
I	I	1	Language	Tamil / Other Language	4	4	0	0	4
	II	2	Language	English	4	4	0	0	4
	III	3	Core -1	Theory of Equations	4	4	0	0	4
	III	4	Core- 2	Calculus	4	4	0	0	4
	III	5	Allied - I	Physics – I	3	3	0	0	3
	III	6	Allied - I	Practical	4	0	0	4	2
	IV	7	Common	Environmental Studies	2	2	0	0	2
II	I	8	Language	Tamil / Other Language	4	4	0	0	4
	II	9	Language	English	4	4	0	0	4
	III	10	Core -3	Analytical Geometry	4	4	0	0	4
	III	11	Core- 4	Vector Calculus	4	4	0	0	4
	III	12	Allied - I	Physics – II	3	3	0	0	3
	III	13	Allied - I	Physics – II (Practical)	4	0	0	4	2
	IV	14	Common	Value based education / Social Harmony	2	2	0	0	2
III	I	15	Language	Tamil/ Other Language	4	4	0	0	4
	II	16	Language	English	4	4	0	0	4
	III	17	Core -5	Real Analysis	4	4	0	0	4
	III	18	Allied – II	Chemistry – I	3	3	0	0	3
	III	19	Allied – II	Practical	4	0	0	4	2
	III	20	Skill based Subject	Programming in C	4	4	0	0	4
	IV	21	Non-major Elective	Basic Mathematics	3	3	0	0	3
	IV		Mandatory	Yoga	2	2	0	0	2
	I	22	Language	Tamil / Other Language	4	4	0	0	4
	II	23	Language	English	4	4	0	0	4
	III	24	Core - 6	Differential Equations	4	4	0	0	4
	III	25	Allied – II	Chemistry – II	3	3	0	0	3

					L	T	P		C
IV	III	26	Allied – II	Chemistry II – Practical	4	0	0	4	2
	III	27	Skill based Subject	Latex and Matlab	4	4	0	0	4
	IV	28	Non-major Elective	Discrete Mathematics	3	3	0	0	3
	IV		Mandatory	Computers for digital era	2	2	0	*	2
	V		Extension activity	NCC/NSS/YRC/YWF	2	0	0	2	1
V	III	29	Core – 7	Abstract Algebra	4	4	0	0	4
	III	30	Core – 8	Theory of Metric Spaces	4	4	0	0	4
	III	31	Core – 9	Statics	4	4	0	0	4
	III	32	Major Elective-I		3	3	0	0	3
	III	33	Major Elective-II		3	3	0	0	3
	IV	34	Skill based Subject (common)	Personality Development/ Effective Communication/ Youth Leadership	4	4	0	0	4
VI	III	35	Core -10	Complex Analysis	4	4	0	0	4
	III	36	Core -11	Linear algebra	4	4	0	0	4
	III	37	Core -12	Graph Theory	4	4	0	0	4
	III	38	Core -13	Dynamics	4	4	0	0	4
	III	39	Major Elective-III		3	3	0	0	3
		40.	Group Project		4	4	0	0	4
				Total	154				140

* 10 hours for practical.

L- Lecture   T- Tutorials   P- Practicals

List of Major Elective Papers

1. Elementary Number Theory
2. Statistics - I
3. Statistics – I
4. Numerical Methods
5. Linear Programming
6. Combinatorial Mathematics
7. Coding Theory
8. Operations Research
9. Mathematical Programming Using JAVA
10. Integral transforms and applications
11. Special Functions
12. Mathematical Logic
13. Astronomy

DETAILED SYLLABUS

Semester I

Core Paper - 1 : Theory of Equations   (60 hours)

Unit I : Theory of equations : Remainder theorem – imaginary roots – irrational roots – relations roots and coefficients   **(12 hours)**

Unit II : Symmetric function of the roots - Sum of the powers of the roots – Newton's theorem
                                                                          (12 hours)

Unit III : Transformations of equations - Transformations of equations in general   **(12 hours)**

Unit IV : Reciprocal equations - Descarte's rule of signs - Rolle's theorem – multiple roots.
                                                                          (12 hours)

Unit V : The Cubic equation - Cardan's method - The Biquadratic equation – Ferrari's method.
                                                                          (12 hours)

Text Books : 1**.** Algebra (Volume I) – T.K.Manicavachagom Pillay, T. Natarajan and K.S.

Ganapathy, S.Viswanathan (Printers and Publishers) Pvt. Ltd. 2008 (Unit I : Chapter 6 - Sections 1 to 12, Unit II : Chapter 6 – Sections 13 to 15, 21 Unit III : Chapter 6 – Sections 16, 24, 25, 26)

        2.   Set theory, Number System and theory of equations, S. Arumugam and A. Thangapandi Isaac, New gamma publishing house, 1992 (For Unit IV; Chapter 5 – Sections 5.8 and 5.9)

Core Paper - 2 : Calculus   (60 hours)

Unit I : Limit of a real function – Continuity.   **(12 hours)**

Unit II: Derivative - Simple examples - Rolle's theorem - Mean value theorem.   **(12 hours)**

Unit III : Envelopes – Curvature – Circle, radius and centre of curvature - Radius of Curvature in Cartesian, parametric and polar co-ordinates.   **(12 hours)**

Unit IV : Evolutes and involutes – Pedal equation of a curve.   **(12 hours)**

Unit V : Linear asymptotes – Tracing of curves.   **(12 hours)**

Text Books:

1. Methods of Real Analysis : Richard R. Goldberg , Oxford & IBH Publishing (for Units I and II)

2. Calculus Vol. I : S. Narayanan and T.K.Manicavachagom Pillay, S.Viswanathan Printers and Publishers Pvt. Ltd. (for Units III,IV and V ; Chapters X, XI, XIII).

Allied – I
Physics - I
Physics I : Practical

(Syllabus as prepared by Physics BoS).

Semester II

Core Paper - 3 : Analytical Geometry   (60 hours)

Unit I : . Direction cosines – direction ratios – equation of planes – standard form - normal form – intercept form   **(12 hours)**

Unit II : Angle between two planes - Lines – symmetrical form. Angle between two planes- image of a point – image of a line   **(12 hours)**

Unit III : Skew lines – shortest distance between two lines – coplanar lines.   **(12 hours)**

Unit IV: Sphere – plane section of a sphere – tangent plane - intersection of two spheres- intersection of a plane with sphere   **(12 hours)**

Unit V : Cone and Cylinder..

Text books:

1. A text book of Analytical Geometry - Part II – Three dimensions - T.K Manicavachagom Pillay and T. Natarajan - S.Viswanathan Printers and Publishers Pvt. Ltd. - 2008. (for Units III, IV and V , Chapters I to IV and Chapter V- Sections 1 to 7.)

Core Paper - 4 : Vector Calculus   (60 hours)

Unit I : Vector differentiation – gradient – divergence – curl – solenoidal and irrotational vector – formulae involving gradient, divergence and curl.   **(12 hours)**

Unit II : Vector integration – line integral – double and triple integral.   **(12 hours)**

Unit III: Jacobians – change of variables .   **(12 hours)**

Unit IV: Line and surface integrals   **(12 hours)**

 Unit V: Theorems of Green, Stokes and Gauss.   **(12 hours)**

Text book: Vector calculus - S. Arumugam and A.Thangapandi Isaac, New gamma publishing house, 2006 (For units I, II,and III- Chapters 5, 6 and & 7) .

Allied – I
Physics II
Physics II - Practical
(Syllabus as prepared by Physics BoS).

Allied - I

Mathematics I   **(45 hours)**

(For students who studied Mathematics at + 2)

Unit I: Theory of equations - Relation between roots and coefficients - symmetric function of the roots in terms of coefficients.   **(9 hours)**

 Unit II: Matrices - Characteristic equation of a matrix - Eigen values and eigen vectors -Cayley Hamilton theorem and simple problems.   **(10 hours)**

Unit III: Differential equation of first order but of higher degree - Equations solvable for p, x, y.

                                            (10 hours)

Unit IV: Laplace transformation - Inverse Laplace transform   **(8 hours)**

Unit V: Solving linear differential equations using Laplace transforms.   **(8 hours)**

Text: Allied Mathematics, S. Arumugam and Others.

Mathematics I : Practical   **(30 hours)**
MATLAB
1. To find the roots of the quadratic polynomial.
2. To find the reciprocal roots of the polynomial.
3. To find the roots of the symmetric function.
4. To find the eigen value of the square matrix.
5. To find the eigen vector of the square matrix.
6. Solve the first order differential equation using MATLAB.

7. Solve the second order differential equation using MATLAB.

8. To find integration when limits are not given.

9. To find integration when limits are given.

10. Simple 2-D, 3-D plots by using MATLAB.

Mathematics II **(45 hours)**

(For students who studied Mathematics at + 2)

Unit I: Vector differentiation – Gradient - Divergence and curl.   **(10 hours)**

Unit II: . Evaluation of double and triple integrals.   **(10 hours)**

Unit III: Vector integration – Line integral,   **(8 hours)**

Unit IV: Surface and volume integrals.   **(8 hours)**

Unit 5: Green's, Stoke's and Divergence Theorems (statement only) - simple problems.

(9 hours)

Text Books: 1. Vector Calculus, S. Arumugam & Others.

   2. Calculus (Volume II), T.K.Manicavachagom Pillay.

Mathematics – II Practical   **(30 hours)**

MATLAB

1. To calculate exponential and logarithm.
2. To calculate values of Trigonometric function.
3. Creating and working with arrays of numbers.
4. To use trigonometric functions with array arguments.
5. To find sum of geometric series.
6. To compute dot product of vectors and   cross product of vectors.
7. To compute box and vector triple product.
8. To compute angle between two vectors.
9. To calculate interest of your money.
10. To define the function using variable as symbol.
11. To find out left and right limit of the given function.
12. To find limit of a function.

Semester III

Core Paper- 5 : Real Analysis   (60 hours)

Unit I : Bounded sets – upper and lower bounds - LUB axiom – Archimedean property – Density of rational and irrationals - Positive n^{th} root of a positive real number.   **(12 hours)**

Unit II : Sequences- Bounded sequences -monotonic sequences – convergent sequences – divergent and oscillating sequences   **(12 hours)**

Unit III : -The algebra of limits. Behaviour of monotonic sequences – some theorems on limit sub sequences – limit points.   **(12 hours)**

Unit IV: Cauchy sequences – Cauchy general principle of convergence of sequences.

(12 hours)

Unit V : Series – infinite series - comparison test - D'Alembert's ratio test - Root test - Cauchy's condensation test.   **(12 hours)**

Text book: Sequences and series – S.Arumugam and A. Thangapandi Isaac, New gamma publishing house.

Allied II

Chemistry I

Chemistry I – Practical

(Syllabus as prepared by the BoS in Chemistry)

Skill Based Elective

PROGRAMMING IN C   (60 hours)

Unit I : Constants – variables - Data types – operations and Expressions – managing input and output operations   **(15 hours)**

Unit II: Decision making and branching - Decision making and looping   **(15 hours)**

Unit III: Arrarys - Handling of character strings   **(10 hours)**

Unit IV: Structures and unions   **(10 hours)**

Unit V: Pointers.   **(10 hours)**

Text Book: Programming in ANSI C – E. Balagurusamy, IV Edition, TMH Publishing Company Limited Chapters 2 to 7, 9 - 11.

Non - major Elective

Basic Mathematics   (45 hours)

UNIT I : Numbers - Face value and place value of a digit in a number - test of divisibility, Applications of algebraic formulae, unit digit - series.   **(10 hours)**

UNIT II : H.C.F. and L.C.M. of numbers - factorization method - common division method, H.C.F. and L.C.M. of decimal fraction - comparison of fractions.   **(10 hours)**

UNIT III : Decimal fraction- conversion of decimal into vulgar fraction-operation son decimal fractions- comparison of fractions-recurring decimal-mixed recurring decimal.   **(9 hours)**

UNIT IV: Simplification - BODMAS Rule - modulus of a real number - virnaculum - Some real life problems - missing numbers in the expression.   **(8 hours)**

UNIT V: Square root and cube root - finding square root by factorization method- perfect square and perfect cube.   **(8 hours)**

Text Book: Quantitative Aptitude – R.S. Aggarwal (2014), S. Chand & Co., Chapters 1 to 5

Semester IV

Core Paper 6 - Differential Equations   (60 hours)

Unit I : Differential Equations of first order and first degree: Variable separable equation - Homogeneous equations – Non-homogeneous equations – Exact equations.   **(12 hours)**

Unit II : Linear differential equations with constant coefficients: Linear differential equations of second order – Homogeneous equations – Fundamental Theorem for the homogeneous equation – Initial value problem – Linear dependence and linear independence of solutions.

(14 hours)

Unit III : General solutions of linear equation $f(D)y = Q(x)$ – Methods for finding the PI in special cases – Euler Cauchy equations – Legendre's linear equations.   **(12 hours)**

Unit IV: Formation of Partial Differential Equation – Method of solving First order PDE—Some standard forms – Charpit's.   **(12 hours)**

Unit V : Partial Differential Equation of Higher order :Homogeneous Differential equations
(10 hours)

Text Books:
1. E. Rukmangadachari, Differential Equations Peaerson edition (2012).
2. Arumugam & Isaac, Differential Equations, New Gamma Publishing House, Palayamkottai (2003).

Allied II

Chemistry II

Chemistry II – Practical

(Syllabus as framed by the BoS in Chemistry)

Skill Based Elective

LaTex and MATLAB   (60 hours)

Unit I : Document Layout and organization – Document class, Page style, Parts of the document, Text formatting, TeX and its offspring, what's different in latex 2(, Distinguishing LaTeX 2(and basics of LaTeX file.   **(12 hours)**

Unit II : Commands and environments-command names and arguments, Environments, Declarations, Lengths, Special characters, Fragile Commands, Exercise. Table of contents, Fine - Tuning text, Word division, Labelling, Referencing, Displayed text – Changing font, Centering and identifying, Lists, Generalized Lists, Theorem like declarations, Tabular stops, Boxes.   **(14 hours)**

Unit III : Tables, Printing literal text, Footnotes and marginal notes. Drawing pictures using LaTeX, Mathematical formulas – mathematical environments, Main elements of math mode, Mathematical symbols, Addition elements, Fine – tuning Mathematics.   **(12 hours)**

Unit IV : Introduction – Basics of MATLAB , Input-output, File types- Platform dependence – General commands.   **(10 hours)**

Unit V : Interactive Computation : Matrices and Vectors – Matrix and array operation-creating and using inline functions-using built – in functions and on-line help-saving and loading data-plotting simple graphs, Basic programming in MATLAB, creating cps files using MATLAB.

                                    (12 hours)

Text Books :

1. A Guideline to LaTeX - H. Kopka and P.W. Daly, Third edition, Addison – Wesley, London, 1999.

2. Getting started with MATLAB – A quick Introduction for Scientists and Engineers- Rudra Pratap, Oxford University Press, 2003

Non- Major Elective

Discrete Mathematics   (45 hours)

Unit I : Mathematical logic: Logical statement or proposition- type of propositions- the propositional calculus - the negation of a proposition- disjunction- conjunction- tautologies and contradictions- logical equivalence - the algebra of propositions- conditional propositions-

converse inverse and contrapositive propositions-the negation of a conditional proposition-biconditional propositions- arguments. **(10 hours)**

Unit II : Set theory: Set- set designation- null sets and unit sets- special sets of numbers- universal set- subsets, proper subsets and equal sets- set operations- union operations- properties of union operation- intersection- properties of intersection operation. **(10 hours)**

Unit III : Distributive properties- complementation- relative complement- properties of complement- properties of difference- symmetric difference- power set- Cartesian products.
(9 hours)

Unit IV : Relation and functions: Relation- equivalence relation- partition- partial order relation.
(8 hours)

Unit V : Function – inverse mapping- composition mappings- binary operations- countable and uncountable sets. **(8 hours)**

Text book: Discrete Mathematics - B. S. Vatssa , 3rd Edition , Wishwa Prakashan , Chapters 1, 2 (except 2.20) and 3.

SEMESTER V

Core Paper 7 - Abstract Algebra (60 hours)

Unit I : Semigroups and groups - homomorphisms – subgroups and cosets **(12 hours)**

Unit II : Cyclic groups - Normal subgroups - quotient groups – isomorphism theorems – automorphisms. **(12 hours)**

Unit III : Permutation groups : Cyclic decomposition – alternating group A_n **(12 hours)**

Unit IV : Rings: Types of rings – Subrings and characteristic of a ring – additional examples of rings **(12 hours)**

Unit V : Ideals – homomorphisms – sum and direct sum of ideals – maximal and prime ideals.
(12 hours)

Text book: Basic Abstract Algebra – P. B. Bhattacharya, S.K.Jain and S.R.Nagpaul , Second Edition , Cambridge University Press
 Unit I - Chapter 4 (Sections 1- 3), Unit II - Chapter 4 (Section 4, Chapter 5 (Sections 1 - 3), Unit III - Chapter 7 (Sections 1 & 2), Unit IV- Chapter 9 (Sections 3 - 5), Unit V - Chapter 10 (Sections 1 - 4).

Core paper 8 - Theory of Metric spaces (60 hours)

Unit I : Metric spaces : Definitions and examples- Bounded sets in a metric space- open ball in a metric space- open sets- subspaces. **(12 hours)**

Unit II: Interior of a set - Closed sets - closure, limit point, dense sets – complete metric space: Introduction - Completeness - Baire's category theorem. **(12 hours)**

Unit III: Continuity : Introduction – Continuity – homeomorphism - uniform continuity.

(12 hours)

Unit IV: Connectedness: Introduction- definition and examples- connected subsets of R- connectedness and continuity. **(12 hours)**

Unit V: Compactness: Introduction- compact space- compact subsets of R – equivalent characterization for compactness-compactness and continuity.

(12 hours)

Text Book : Modern Analysis – S. Arumugam and Thangapandi Isaac, New gamma publishing house . Chapters 2, 3, 4 (except section 4.4) ,5 and 6.

Core Paper 9 - Statics   (60 hours)

Unit I: Forces acting at a point: Resultant and components: Definition- simple cases of finding the resultant-parallelogram of forces: theorem-analytical expression for the resultant of two forces acting at a point- triangle of forces- perpendicular triangle of forces- converse of the triangle of forces- the polygon of forces- Lami's theorem-an extended form of the parallelogram law of forces-resolution of a force- components of a force along two given directions-theorem on resolved parts- resultant of any number of forces acting at a point: Graphical method- resultant of any number of forces acting at a point: Analytical method- conditions of equilibrium of forces acting upon a particle.   **(12 hours)**

Unit II: Parallel forces and moments-: Introduction- to find the resultant of two like parallel forces acting on a rigid body- to find the resultant of two unlike and unequal parallel forces acting on a rigid body- resultant of a number of parallel forces acting on a rigid body- conditions of equilibrium of three coplanar parallel forces-centre of two parallel forces- moment of a force- physical significance of the moment of a force- geometrical representation of a moment- sign of the moment-unit of moment - Varignon's theorem of moments- generalized theorem of moments.   **(12 hours)**

Unit III: Couples: Couples- equilibrium of two couples- equivalence of two couples- couples in parallel planes- representation of a couple by a vector- resultant of coplanar couples- resultant of a couple and a force**.   (12 hours)**

Unit IV: Equilibrium of three forces acting on a rigid body: Rigid body subjected to any three forces-three coplanar forces-conditions of equilibrium-procedure to be followed in solving any statics problem- two trigonometrical theorems - some artifices -problems on parallel forces - miscellaneous problems.   **(12 hours)**

Unit V: Coplanar forces: Introduction- reduction of any number of coplanar forces - conditions for a system of forces to reduce to a single force or to a single couple- alternative conditions for a system of forces to reduce to a single force or to a single couple- change of the base point- equation to the line of action of the resultant - conditions of equilibrium of a system of coplanar forces - second form of the conditions of equilibrium- third   form   of   the   conditions   of   equilibrium –   solution   of   problems**. (12 hours)**

Text Book: A text book of .Statics – M.K. Venkataraman, Agasthiar publications (Chapters 2 - 6).

Semester VI

Core Paper - 10 : Complex Analysis   (60 hours)

Unit I :nth roots of a complex number – circles and straight lines – regions in the complex plane – Riemann's stereographic projection.   **(12 hours)**

Unit II : Differentiability – Cauchy Riemann equations – Analytic functions – Harmonic functions – Power series.   **(12 hours)**

Unit III : Bilinear transformations – cross ratio – fixed points of Bilinear transformations – Mapping properties.   **(12 hours)**

Unit IV:: Complex Integration – Definite integral – Cauchy's theorem – Cauchy's integral formula – higher derivative.   **(12 hours)**

Unit V :: Residues, Cauchy's residue theorem – evaluation of definite integrals – Type I and Type II integrals.   **(12 hours)**

Text Book: Complex Analysis – S. Arumugam and Isaac , Scitech Publications,
.

Core Paper - 11 Linear Algebra   (60 hours)

Unit I : Systems of linear equations – Vector spaces – Definitions and examples – Vector subspaces.   (12 hours)

Unit II : Basis and dimension of a vector space - Definition of a line – Quotient space.   (12 hours)

Unit III : Linear transformations – Representation of linear maps by matrices – Kernel and Image of a linear transformation – Linear isomorphism.   (12 hours)

Unit IV : Inner product spaces – Orthogonality – Orthogonal projection onto a line – Orthonormal basis – Gram-Schmidt orthogonalization process.   (12 hours)

Unit V : Eigen values and eigen vectors – Cayley–Hamilton theorem – Diagonalization of symmetric matrices.   (12 hours)

Text book : Linear algebra – A geometric approach : S. Kumaresan, Prentice-Hall of Indian Pvt. Ltd

Core Paper - 12 Graph Theory   (60 hours)

Unit I: Definition and Examples of Graphs – Degrees – subgraphs – isomorphism – independent sets and coverings – intersection graphs and line graphs – matrices – operation on graphs.   **(12 hours)**

Unit II: Degree sequences – Graphic sequences – Walks – Trials and Paths – connectedness and components – connectivity. **(12 hours)**

Unit III: Eulerian graphs – Hamiltonian graphs – characterization of trees – centre of a tree – Matchings. **(12 hours)**

Unit IV: Definition and Properties of planar graphs – characterization of planar graphs – chromatic number and chromatic index. **(12 hours)**

Unit V: Chromatic polynomials – definition and basic properties of digraphs – paths and connectedness in digraphs - digraphs and matrices. **(12 hours)**

Text Book: Invitation to Graph Theory – S. Arumugam and S. Ramachandran, Scitech Publications Pvt. Ltd. (Chapters 2 to 10).

Core paper - 13 : Dynamics   (60 hours)

Unit I : Projectiles: Definitions – two fundamental principles- to show that the path of a projectile is a parabola- characteristics of the motion of a projectile- projection of a particle from a point at a certain height above the ground –to determine when the horizontal range of a projectile is maximum- two possible directions of projection to obtain a given horizontal range. **(12 hours)**

Unit II : To find the velocity of the projectile- two directions of projection for the particle so as to reach a given point- range on an inclined plane- greatest distance of the projectile- maximum range- two directions of projection for the particle so as to obtain a given range - motion on the surface of a smooth inclined plane- enveloping parabola. **(12 hours)**

Unit III: Collision of elastic bodies: Definitions- fundamental laws of impacts - impact of a smooth sphere on a fixed smooth plane - direct impact of two smooth spheres- loss of kinetic energy   due to impact of two smooth spheres. **(12 hours)**

Unit IV: Oblique impact of two smooth spheres- loss of kinetic energy   due to oblique impact of two smooth spheres – dissipation of energy due to impact - compression and restitution- impact of a particle on a rough plane. **(12 hours)**

Unit V: Simple Harmonic motion: Simple harmonic motion in a straight line - geometrical representation of a simple harmonic motion - change of origin- composition of two simple harmonic motions - motion of a particle suspended by a spiral spring - horizontal oscillations - simple harmonic motion on a curve- simple pendulum- period of oscillation of a simple pendulum - equivalent simple pendulum - the seconds pendulum - loss or gain in the number of oscillations made by a pendulum. **(12 hours)**

Text Book: A text book of .Dynamics – M.K. Venkataraman, Agasthiar publications

(Chapters 6 (except 6.18) , 8, and 10).

MAJOR ELECTIVE PAPERS

1. Elementary Number Theory   (45 hours)

Unit I : The natural numbers - Peano's postulates - Law of trichotomy -Second principle of induction.   **(9 hours)**
Unit II : Construction of integers - Divisibility in Z - Division algorithm - Euclidean algorithm.
                                                              (9 hours)
Unit III : Construction of rational numbers - Archimedean ordered field - countability of Q and other properties - Construction of R as a completion of Q.   **(9 hours)**
Unit IV : Congruences - The Chinese remainder theorem - Fermat's theorem - Euler's theorem - Wilson's theorem.   **(9 hours)**
Unit V : Primes and their distribution - The fundamental theorem of arithmetic - The Sieve of Eratosthenes.   **(9 hours)**
Text Books:
1. Number System - S.Arumugam and A.Thangapandi Isaac, New gamma Publishing house (for units I to IV)
2. Elementary number theory - David M.Burton, Tata McGraw Hill(for unit V)

2. Statistics – I   (45 hours)

Unit I : Moments, Skewness and Kurtosis – Curve fitting – Method of least squares-Fitting lines - Parabolic, Exponential and logarithmic curves.   **(9 hours)**
Unit II : Correlation and regression – Scatter diagram – Karl Pearson's coefficient of correlation – Properties – Lines of regression, Regression coefficient and properties – Rank correlation.   **(9 hours)**
Unit III : Theory of attributes: Attributes - Consistency of data – independence and association of data – Yule's coefficient of association.   **(9 hours)**
Unit IV : Discrete Probability Distributions: Geometric, Binomial and Poisson distributions – Their moment generating function, Characteristic function, Properties and simple application.   **(9 hours)**
Unit V : Continuous Probability Distributions: Beta and Gamma Distributions, Normal distribution – Standard normal distribution – Their properties – Simple Problems – Importance of normal distribution.   **(9 hours)**
Text Book: Statistics – S. Arumugam and A. Thangapandi Isaac, New gamma publishing house, June 2007 (Chapters 4, 5,6,8 and 13)

3. Statistics – II   (45 hours)

Unit I : Tests of Significance (Large samples) : Sampling distribution – Testing of Hypothesis – Type I and Type II errors – Critical region, level of significance – Test of significance for large samples – Testing a single proportion – Difference of proportions – testing a single mean – Difference of means.   **(9 hours)**

Unit II : Tests of Significance (Large samples) : Tests based on t – distribution – Single mean – Difference of means – Tests based on F - distribution. **(9 hours)**

Unit III : Test based on chi square distribution –Goodness of fit - Independence of attributes. **(9 hours)**

Unit IV : Analysis of time series : Time series – Components of a time series _ measurement of trends. **(9 hours)**

Unit V : Analysis of Variance – One criterion of classification - Two criteria of classification – Three criteria of classification. **(9 hours)**

Text Book : Statistics – S.Arumugam and A. Thangapandi Isaac, New gamma publishing House, June 2007 (For Unit I – III - Chapters 14, 15 and 16, For Unit IV – Chapter 10, For Unit V – Chapter 17).

4. Numerical Methods   (45 hours)

Unit I: Errors in Numerical Calculations: Errors and their computations - A general error formula - Error in a series. Approximation Solution of Algebraic and Transcendental equations: The Bisection method – The Method of False position - Iteration method - Newton - Raphson method. **(9 hours)**

Unit II: Interpolation: Finite differences - Forward Differences – Backward Differences - Central Differences - Symbolic Relations and Separation of Symbols. Newton's Formulae for Interpolation - Gauss's central difference formulae - Stirling's formula - Interpolation with unevenly spaced points: Lagrange's interpolation formula - Inverse Interpolation. **(9 hours)**

Unit III: Numerical Differentiation: Derivatives using Newton's Forward Difference Formula – Derivatives using Newton's Backward Difference Formula - Derivatives using Stirling's Formula - Maxima and Minima of Tabulated Function. Numerical Integration: General Quadrature Formula - Trapezoidal Rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule. **(9 hours)**

Unit IV : Numerical Solutions of System of Linear Equations: Gauss elimination method - Gauss - Jordan method - Jacobi's method - Gauss - Seidel method. **(9 hours)**

Unit V : Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series - Picard's method of successive approximations – Runge - Kutta Methods - Milne's Predictor -Corrector Method. **(9 hours)**

Text Book : S. S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India, Pvt. Ltd., New Delhi (Fourth Edition, 2005).

5. Linear Programming   (45 hours)

Unit I : Definition - examples - Mathematical formulation – standard form - Theorems (statements only) - Graphical solution - simplex method.   **(9 hours)**

Unit II : The Big-M method – Two phase simplex method   **(9 hours)**

Unit III : Duality – The dual of the dual is the primal – Duality theorems (Statements only) – Dual simplex method.   **(8 hours)**

Unit IV : Transportation problem – Mathematical formulation – North west corner rule – method of matrix minima - Vogel's Approximation method – MODI optimality test - Assignment problem.   **(10 hours)**

Unit V : Integer Programming : Gomory's cutting plane method - Branch and bound method.   **(9 hours)**

Text Book : Operations Research – Kanti Swarup , P.K. Gupta and Man Mohan. (Relevant Sections from Chapters 2, 3, 4, 6, 7 and 14). .

6. Combinatorial Mathematics   (45 hours)

Unit I : Selections and binomial coefficients - permutations – ordered selections – unordered selections.   **(9 hours)**

Unit II : Pairing problems – pairings within a set -pairing between sets – an optional assignment problem.   **(9 hours)**

Unit III : Recurrence – Fibonacci type relations – using generating functions.   **(9 hours)**

Unit IV : The Inclusion – Exclusion principle – the principle – Rook polynomials.   **(9 hours)**

Unit V : Block design and error correcting codes – Block designs – square block designs.   **(9 hours)**

Text Books : 1. A first course in combinatorial mathematics – Ian Anderson.

2.Discrete Mathematics and its applications. – Kenneth H. Rosen.

7. Coding Theory   (45 hours)

Unit I : Basic assumptions – correcting and detecting error patterns-information rate – effects of error correction and detection – finding the most likely code word transmitted.   **(9 hours)**

Unit II : Linear codes – two important sub-spaces-independence –basic, dimension – matrices-Bases for C and C^+ generating matrices on coding.   **(9 hours)**

Unit III : Parity check matrices-equivalent codes-distance of a linear code – Linear codes

– cosets – MLD for linear codes - Reliability of IMLD for linear codes.   **(9 hours)**

Unit IV : Some bounds for codes – perfect codes-hamming codes-extended codes-The extended Golay code – decoding the extended Golay code – Golay code.   **(9 hours)**

Unit V : Polynomials and words-introduction to cyclic codes – Polynomial encoding and decoding –finding cyclic codes – Dual cyclic codes.   **(9 hours)**

Text Book : Coding Theory, the essentials - Hoffman et.al.- (Chapters 1 to 4 except sections 3.8,3.9) Marcel Dekker, Inc. Madtrison Avenue, Newyork.

8. Operations Research   (45 hours)

Unit I : Inventory – deterministic models - uniform rate of demand, infinite state of production and no shortage - Uniform rate of demand, finite rate of replenishment and no shortage - Uniform rate of demand, instantaneous production with shortages. **(9 hours)**

Unit II : Queuing Theory – General concepts and definitions – classification of Queues – Poisson process – properties of Poisson process models:
  i.   (M/M/1) :   (∞/FCFS)
  ii.   (M/M/1) :   (N/FCFS)
  iii. (M/M/S):   (∞/FCFS)   **(9 hours)**

Unit III : Network Analysis – Drawing Network diagram – critical path method – labelling method – concept of slack and floats on network – PERT – Difference in PERT and CPM.   **(9 hours)**

Unit IV : Non – linear Programming :   General Non-linear Programming Problem – Problem of constrained maxima and minima – graphical solution – saddle point problems – saddle points and N. L.P.P.   **(9 hours)**

Unit V : Non – linear Programming Techniques : Kuhn – Tucker conditions – Non-negative constraints – Quadratic Programming – Wolfe's modified simplex method- Beale's method – Separable convex programming.   **(9 hours)**

Text Book : Operations Research – Kanti Swarup, P.K. Gupta and Man Mohan. (Relevant Sections from Chapters 12, 13, 16, 17 and 19).

9. Mathematical Programming Using JAVA   (45 hours)

Unit I : Introduction to JAVA – History – overview – JAVA application programs – JAVA Applets – commands line arguments – Data types – variables – comments.   **(9 hours)**

Unit II : Objects and Classes – Defining a class – constructors – multiple constructors – wrapper classes – conversion of data types – command live and keyboard input – Attributes and methods – Attributes – overriding – object composition with a simple example.   (9 hours)

Unit III : If structure – nested if structure – break and labelled break – switch structures

while loop – do loop – for loop – natural sum and partial sum of series using loops – Divergent series verification using loops – nested loop. (9 hours)

Unit IV : HTML entity encoding in JAVA – JAVA string encoding- attributes – encoding schemes that are supported by the JAVA platform – character encoding – objects , Images and applets in HTML documents. (9 hours)

Unit V : JAVA script – Grammar - objects –functions – inheritance – arrays. (9 hours)

Reference Books:

1. JAVA 2 programming – C. Xavier , Scitech Publication
2. The Complete Reference JAVA 2 – Herbert Schildt.

10. Integral transforms and applications   (45 hours)

Unit I: The Laplace transforms : Definition – sufficient conditions for the existence of the Laplace transform – Laplace transform of periodic functions – some general theorems.

(9 hours)

Unit II : The inverse transforms. **(9 hours)**

Unit III: Applications to differential equations – solving simultaneous equations and differential equations with variable coefficients. **(9 hours)**

Unit IV : Fourier series – even and odd functions – half – range Fourier series. **(9 hours)**

Unit V : Developments in Cosine series – sine series – Change of intervals – Combination of series. **(9 hours)**

Text Book : Calculus – Volume III- S. Narayanan and T. K. Manicavachagom Pillay- S. Viswanathan (Printers and Publishers) Pvt. Ltd.2008 (Chapters 5 and 6 (Sections 1 to 7)

11. Special Functions   (45 hours)

Unit I : The exponential function - the logarithmic function – definition of x^a – the trigonometric functions. **(9 hours)**

Unit II : Beta and gamma functions. **(9 hours)**

Unit III : Applications of Gamma functions to multiple integrals. **(9 hours)**

Unit IV : Legendre 's equation - solution – Legendre's function of the first and second kinds - Orthogonal properties of Legendre's Polynomial. **(9 hours)**

Unit V : Bessel's equations and Bessel's functions – Definition and solution – Bessel's function of the first kind of order n – generating function- some trigonometric expansions involving Bessel's functions. **(9 hours)**

Text Book:

1. Methods of Real analysis – R.R.Goldberg (For Unit I – Chapter 8 –Sections 8.2 to 8.4)
2. Calculus - Volume II - S. Narayanan and T. K. Manicavachagom Pillay- S. Viswanathan (Printers and Publishers) Pvt. Ltd. 2008 (For Unit II – Chapter 7 – Sections 1 to 5 : For Unit III Chapter 7 – Section 6).
3. Differential Equations and Integral transforms – U.P. Singh, R.Y. Denis , S. K.D. Dubey and K.N.Singh , Dominant Publishers and Distributors (For Unit IV - 4.1 and for Unit V –

4.2).

12. Mathematical Logic   (45 hours)

Unit I : Mathematical Induction – Techniques of proof.   **(9 hours)**
Unit II : Mathematical logic – Statements and notations – connectives – statement formulas and truth tables – conditional and biconditional statements – well formed formulas.
                                                                            (9 hours)
Unit III : Tautology – equivalence of formulas- duality law – principal disjunctive and conjunctive normal forms.   **(9 hours)**
Unit IV : Axiom of choice – Zorn's lemma – well –ordering – Zermelo's theorem – Schroder- Bernstein theorem.   **(9 hours)**
Unit V : Ordinals and Cardinals.   **(9 hours)**
Text Book:
1. Discrete Mathematics by M.K. Venkataraman . N. Sridharan and N. Chandrasekaran , The National Publishing Company (Edition – June 2006) (For units I, II and III).
2. Naïve set theory by Paul.R. Halmos, Springer International Edition
(For Unit IV –Chapters 15 to 17 and 22; For Unit V – Chapters 19 to 21,24 and 25).

13. Astronomy   (45 hours)

Unit I	:	Spherical Trigonometry – Celestial sphere- Diurnal motion. **(9 hours)**
Unit II	:	Earth – the zones of Earth – Terrestrial latitudes and longitudes – radius of earth – rotation of earth – Dip of horizon – Twilight. **(9 hours)**
Unit III	:	Refraction laws of refraction – effects of refraction – cassini's formula horizontal refraction. **(9 hours)**
Unit IV	:	Geocetric parallax – effects – horizontal parallax of moon – angular diameter – comparison of geocentric parallax and refraction. **(9 hours)**
Unit V	:	Kepler's laws – longitude of perigee – eccentricity of earth's orbit – verification of Kepler's laws in the case of Earth Newton's deductions form Kepler's laws mean anomaly -Geocentric and heliocentric latitudes and longitudes. **(9 hours)**

Text Book: Astronomy – S. Kumaravelu and Susheela Kumaravelu.

Semester VII to X

Syllabus and scheme of examination as per that of the 2-year M.Sc (Mathematics) Degree program of the University Department of Mathematics.

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