MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Mathematics

(Choice Based Credit System)
(with effect from the academic year 2016-2017 onwards)
(44th SCAA meeting held on 30.05.2016)

V	I	25	Core - 7	Real Analysis –II	7	5	25	75	100	30	40
	II	26	Core - 8	Mechanics	7	5	25	75	100	30	40
	III	27	Major Elective-I	A) Numerical Methods B) Astronomy – I C) Discrete Mathematics	6	5	25	75	100	30	40
		28	Major Elective-II	A) Combinatorial Mathematics B) Operations Research C) Coding Theory	6	5	25	75	100	30	40
	IV	29	Skilled Based subject (Common)	Personality Development/ Effective Communication/ Youth Leadership	4	4	25	75	100	30	40
				Subtotal	30	24					
VI	I	30	Core - 9	Abstract algebra –II	6	5	25	75	100	30	40
	II	31	Core - 10	Complex Analysis	6	5	25	75	100	30	40
	III	32	Core – 11	Number Theory	6	5	25	75	100	30	40
		33	Core - 12	Graph Theory	6	5	25	75	100	30	40
	IV	34	Major Elective-III	A) Fuzzy Mathematics – I B) Astronomy – II C) Mathematics Modelling	6	5	25	75	100	30	40
				Subtotal	30	25					

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Core - 7

REAL ANALYSIS - II (105 Hours) (JMMA52)

Unit I Metric spaces – Examples – bounded sets – open ball – open sets – subspaces – Interior of a set.

Unit II Closed sets – closure – Limit points – Dense sets – complete metric space – Cantor's intersection theorem – Baire's Category Theorem.

Unit III Continuous functions on metric spaces : Functions - continuous at a point on the real line – Functions - Continuous – uniform continuous in a metric space – Discontinuous function or R^1.

Unit IV Connectedness and compactness : Connectedness – connected subset of R – connectedness and continuity – compact metric spaces – compact subset of R^1 – Heine Borel theorem.

Unit V **Riemann Integral :**
Sets of measure zero – Existence of the Riemann integral – Derivatives – Rolle's theorem – Fundamental theorem of Calculus – Mean value theorem – Cauchy's mean value theorem – Taylor's theorem.

Text Books:

Arumugam & Others – Modern Analysis

* Malic .S.C – Mathematical Analysis, Wiley Eastern Limited, New Delhi.

Books for Reference :

1. Tom .M. Apostal – Mathematical Analysis, II Edition, Narosa Publishing House, New Delhi (Unit I) (1997)
2. Goldberg .R – Methods of Real Analysis Oxford and IBH Publishing Co. New Delhi (200)
3. Viswanath Naik .K – Real Analysis, Emerald Publishers, Chennai.
4. Malic .S.C and Savitha Arora (1991) - Mathematical Analysis, Wiley Eastern Limited, New Delhi.
5. Berberian .S.K – First course in Real Analysis, Springer Verlag, New York.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Core - 8

MECHANICS (90 Hours) (JMMA53)

Unit I **Forces acting at a point :** Forces acting at a point – types of forces – Triangle of forces – Polygon of forces – Lami's theorem – Parallel Forces and moments – Resultant of two like parallel forces, unlike and unequal parallel forces – moment of a force – Varignon's theorem of moments.

Unit II **Equilibrium of Strings and Chains :** Equilibrium of strings and chains – Common catenary – Suspension bridge.

Unit III **Projectiles :** Projectiles : Equation of Path – Maximum height – Time of flight – Range.

Unit IV **Simple Harmonic Motion :** Simple harmonic motion (SHM) in a straight line – Geometrical representation – Composition of SHM's of same period in the same line and along two perpendicular direction – SHM as a curve – Simple pendulum – Simple equivalent pendulum. The seconds pendulum.

Unit V **Motion under the action of Central Forces :** Velocity and acceleration in Polar co-ordinates – Differential equation of Central Orbit – Pedal equation of Central Orbit.

Text Books :

- Venkataraman .M.K., - Statics, Agastiar Publications 2002, Trichy.
- Venkataraman .M.K, -A text book on Dynamics, 2001, Agastiar Publications, Trichy.

Books for Reference :

1. Venkataraman .M.K., - Statics, Agastiar Publications 2002, Trichy.
2. Venkataraman .M.K, - A text book on Dynamics, 2001, Agastiar Publications, Trichy.
3. Duraipandian .P, Laxmi Duraipandian and Muthumizh Jayapragasam, Mechanics, 2003, S.Chand and Company.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Major Elective – I (A)

NUMERICAL METHODS

Unit I Solution of Numerical algebraic and Transcendental Equations : bisection method – Newton's method. Criterion of order of convergence of Newton's method. Regula False method – Gauss elimination – Gauss Jacobi – Gauss Seidal method

Unit II **Finite Difference :** First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial –Factorial polynomial – Error propagation operator E and E^{-1}. Relation among Δ, E, δ and D

Unit III Interpolation : Newton's Forward – backward, Gauss forward – backward interpolation formula – Bessel's formula. Divided differences – Newton's divided difference formula – Legrange's interpolation formule – Inverse interpolation formula.

Unit IV Numerical Differentation and Integration : Newtons forward and backward differences for differentiation – Derivatives using Bessel's formula – Trapezoidal rule, simpson's 1/3 rule & 3/8 rule – Weddle's rule.

Unit V **Difference Equations :** Definition – order and degree of difference equation – Linear difference equation – Finding complementary function – particular Integral – simple applications.

Text Books :

- Venkataraman .M.L – Numerical methods in Science and Engineering National Publishing Company V Edition 1998.

Books for Reference :

1. Kandasamy .P.K. Thilagavathy and K. Gunavathy 'Numerical Methods' S. Chand & Company Ltd. Edn. 2006.
2. B. Stephen John – Numerical Analysis
3. Venkatraman .M.L - Numerical methods in Science and Engineering National Publishing Company V Edition 1998.
4. Autar Kaw and Egwwn Enc Kalu - Numerical methods with Application Abidet. Autokaw.com 2nd 2011.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Major Elective – I (B)

ASTRONOMY - I

Unit I **Spherical Trigonometry**

Spherical triangle – The fundamental formula of Spherical trigonometry, the sine, cosine, four parts and Napier formula (without proof) and simple problems.

Unit II **The celestial sphere**

Celestial co-ordinates – Diurnal motion – Rising and setting of a star – sidereal time – circumpolar stars – Morning and evening stars - Twilight.

Unit III Earth – length of a day – Refraction – Tangent formula – Cassini's formula – Effects of refraction

Unit IV Geocentric parallax – Effects – Heliocentric parallax – Effects – Aberration - Effects

Unit V Kepler's laws – verification of Kepler's laws – True anomaly, mean anomaly, Eccentic anomaly – Relation between them.

Text Books :

- Kumaravelu .S and Susheela Kumaravelu – Astronomy for degree classes, Rainbow Printers, Nagercoil (2005).

Books for Reference :

1. Ramachandran .G.V - Astonomy

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Major Elective – I (C)

DISCRETE MATHEMATICS

Unit I **(Mathematical logic)** Statement and notation – Connectives – Negation – Conjunction – Disjunctions – Statement formula and truth table – conditional and Biconditional – Well defined formulae – Tautologies – Equivalence of formulae – Quality laws – Normal forms.

Unit II **(Algebraic Structures)**
Groups and Monoids – Simple properties – group codes.

Unit III **(Lattices and Boolean algebra)**
Lattices and Posets – Properties of lattices – special lattices – Boolean algebra – Gating networks – Minimal sums of products – Karnaugh maps.

Unit IV **(Languages)**
Finite state Machines language – the set theory and strings – Finite state machine – A first encounter – Finite state machine – second encounter.

Unit V **(Number system and codes)**
Decimal, Binary, octal, Hexadecimal – Conversion from one to another – Binary addition, subtraction multiplication and division – BCD – weighted excess time – Gray code – ASCII Code,

Text Book:

- Tremblay and Manohar – Discrete Mathematical Structures with application to Computer Science, (Tata McGraw Hill, New Delhi) 1997.

Books for Reference :

1. Ralph P. Grumaldi Pearson Edelen – Discrete and Combinatorial Mathematics – an applied Introduction (IV edition)
2. Maluino .A and Leech – Digital Principles and Application McgraHill.
3. Venkataraman .M.K. and others – Discrete mathematics 2000 The National Publishing Company.
4. Balaji .G – Discrete Mathematics – Balaji Publishers, Chennai (2013)
5. Veerarajan .T – Discrete mathematics – Tata McGraw Hill – (2009)

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Major Elective – II (A)

Combinatorial Mathematics

Unit I Selections and Binomial coefficients – Permutations – Ordered Selections – Unordered Selections – Miscellaneous Problems.

Unit II Pairings Problems - Pairings within a set – Pairings between sets – An optional assignment problem.

Unit III Recurrence – Fibonacci – type relations. Using generating functions – Miscellaneous methods.

Unit IV The inclusion – Exclusion Principles – The Principle – Rook Polynomials

Unit V Block designs – Square Block designs

Text Books :

1. Ian Andersen – A first course in combinatorial Mathematics – Clarendon Press, Oxford.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-V/ Major Elective – II (B)

Operations Research

Unit I **Linear Programming Problem :** Mathematical formulation of LPP – Simplex Method – Artificial variable technique – Concept of Duality – Primal and Dual Problems – Duality – Dual Simplex Method.

Unit II **Transportation Problem :** North-West Corner Rule – Matrix Minima method – Vogel's Approximation Method – MODI Method – Degeneracy and Unbalanced Transportation Problem.

Assignment Problem : Hungarian Method – Unbalance Assignment Problem

Unit III **Games and Strategies :** Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of 2 x n and m x 2 games – Dominance Property.

Unit IV **Network scheduling by PERT / CPM :** Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method – PERT Calculation.

Unit V **Inventory Control :** Introductions – Types of Inventories – Inventory decisions – Deterministic inventory Problem – EOQ problems with shortages.

Text Book:

- KantiSwarup, P.K. Gupta and Manmohan – Operations Research – Sultan Chand & Sons – 2006, 12th edition.

Books for Reference :

1. Gupta .P.K and D.S. Hira – Operations Research – S. Chand and Company.
2. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali - Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
3. Hillier, F.S. and G.J. Lieberman - Introduction to Operations Research, 9th Ed., Tata McGrawHill, Singapore, 2009.
4. Hamdy A. Taha, - Operations Research, An Introduction, 8th Ed., Prentice – Hall India, 2006.
5. Hadley .G. - Linear Programming, Narosa Publishing House, New Delhi, 2002.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) /
Semester-V/ Major Elective – II (C)

Coding Theory

Unit I Basic assumptions – Correcting and detecting error patterns – information rate – effects of error correction and detection – finding the most likely code word transmitted.

Unit II Linear codes – two important – subspaces independence – basic, dimension – matrices – Bases for C and C^+ generating matrices on coding.

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.

Unit IV Some bounds for codes – perfect codes – hamming codes – extended codes – The extended Golay code – decoding the extended Golay code – Golay code.

Unit V Polynomials and words – introduction to cyclic codes – introduction to cyclic codes – Polynomial encoding and decoding – finding cyclic codes – Dual cyclic codes.

Text Book :

1. Coding theory, the essentials – Marcel Dekker, Inc. Madtrison Avenue, Newyork.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Core - 9

ABSTRACT ALGEBRA II (105 Hours) (JMMA51)

Unit I **Vector Spaces :** Definition and examples – elementary properties – subspaces – linear transformation – fundamental theorem of homomorphism.

Unit II Span of a set – linear dependence and independence – basis and dimension - theorems

Unit III Rank and nullity Theorem – matrix of a linear transformation
Inner product space : Definition and examples – orthogonality – orthogonal complement – Gram Schmidt orthognalisation process.

Unit IV **Matrices :** Elementary transformation – inverse – rank – test for consistency – solving linear equations.

Unit V Cayley Hamilton theorem – Applications of Cayley Hamilton theorem – Eigen values and Eigen vectors – Properties and problems.

Text Book: Arumugam & others – Modern Algebra

Books for Reference :

1. Shama .J.N and Vashistha .A.R, "Linear Algebra", Krishna Prakash Nandir, 1981.
2. John B. Fraleigh, "A First Course in Abstract Algebra", 7th edition, Pearson, 2002.
3. Strang G., "Introduction to Linear Algebra", 4th edition, Wellesly Cambridge Press, Wellesly, 2009.
4. Artin M., "Abstract Algebra", 2nd edition, Pearson, 2011.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Core - 10

COMPLEX ANALYSIS

Unit I **(Analytic functions)**

Functions of a complex variable – Derivatives – Cauchy – Riemann equations – sufficient conditions – Polar form – Analytic functions – Harmonic functions.

Unit II **(Integrals)**

Definite integrals – Contours – Cauchy – Goursat theorem – antiderivatives and independence of path – Cauchy Integral formula – Morera's theorem.

Unit III **(Series)**

Taylor's series – Examples – Laurent's series – Zeros of analytic functions – Residues – Residue theorem – Principal part of functions – Residues at poles.

Unit IV **(Evaluation of Integrals)**

Evaluation of improper real integrals – improper integrals involving sines and cosines – Definite integrals involving sines and coines.

Unit V **(Transformations)**

Conformal mappings – basic properties – Bilinear maps – fixed points - Applications

Text Book :

- Arumugam .S and T. Issac –"Complex Analysis" – Scitech Publishing House – Chennai.

Books for Reference :

1. Churchill .R.V. and J.W. Brown – "Complex variables and Applications" – IV edition – McGraw Hill International Editions.
2. Ponnuswamy .S – "Foundations of Complex Analysis", Narosa Publication House, New Delhi, II edition 2005.
3. Duraipandian .P and Lakshmi Duraipandian – "Complex Analysis" – Emerald Publications, Chennai (2001)
4. Shakarchi .R, Problems and solutions of Complex Analysis. Springer – Verlag, New York 1999.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Core -11

NUMBER THEORY

Unit I Peano's Axioms – Mathematical Induction – The Binomial Theorem – Early Number Theory.

Unit II Division Algorithm – GCD – Euclidean Algorithm – The Diaphantine Equation $ax + by = c$.

Unit III The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes – The Goldbach conjecture.

Unit IV Basis properties of congruences – Linear congruence and the Chinese Remainder Theorem.

Unit V Fermat's Theorem – Wilson's Theorem – The Fermat – Kraitchik Factorization Method.

Text Book:

- David .M. Burton - Elementary Number Theory (Sixth Edition) Tata McGraw Hill Education Pvt. Ltd.

Books for Reference :

1. Ivan Niven and H, Zuckerman - An Introduction to Theory of Numbers.
2. Kumaravelu .S, and Susheela Kumaravelu - Elements Theory - Nagercoil, 2002.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/Core – 12

GRAPH THEORY (90 Hours)

Unit I Finite and infinite graphs – degree – Isolated vertex, pendent vertex and null graph – walks, paths and cycles (Definite and examples only) subgraphs – connected and disconnected graph, Eulerian and Hamiltonian

Unit II Trees and fundamental circuits – properties of Trees - distance and centre, binary tree, spanning tree, cut set and cut vertices - properties – connectivity.

Unit III Planar and dual graphs - different representation of planar graphs – Detection of planarity.

Unit IV Graph operations (unions, composition, product) matrix representation – incident, adjacency matrix – rank – cell set matrix – Relations, path matrix

Unit V Chromatic number – chromatic partitioning. Chromatic polynomial – domination – Covering (definition and examples only) - colouring – five colour Theorem - Four Colour problem.

Text Book:

- Arumugam .S and S. Ramachandran - Invitation to Graph Theory - Scitech Publications India Pvt. Limited Chennai (2004 edition)

Books for Reference :

1. Narasing Deo – Graph Theory with applications to Engineering and Computer Science - Hall of India Pvt. Ltd.
2. Kumaravelu .S – Graph Theory – Edition 1
3. Gowthem - Graph Theory
4. Roberts .F.S - Graph Theory and its Applications to problems of Society - SIAM. Odyssey Press, New Hamphire 1978.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Major Elective – III (A)

FUZZY MATHEMATICS

Unit I **Crisp Sets – Fuzzy Sets –** Basic Types – Basic Concepts – Characteristics and Significance of the Paradigm shift.

Unit II Additional properties of α-cuts – representations of fuzzy sets – Extension principle for fuzzy sets.

Unit III **Fuzzy set operations –** Fuzzy complements – Fuzzy intersections : t-norms – Fuzzy Unions : t-conorms – Combinations of operations – Aggregation operations.

Unit IV **Fuzzy Numbers –** Linguistic variables – Arithmetic operations on intervals – Arithmetic operations of fuzzy numbers – Lattice of fuzzy numbers – Fuzzy Equations.

Unit V Fuzzy Decision Making – Individual Decision Making – Multi-person decision making – Fuzzy linear Programming.

Text Book:

* George J. Klir and Bo Bo Yuan – Fuzzy sets and Fuzzy Logic Theory Applications, Prentice Hall of India, 2002, New Delhi.

Books for Reference :

1. George J. Klir and Tina .A Folger – Fuzzy sets, uncertainty and Informations – Prentice Hall of India, 2003, New Delhi.

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Major Elective – III (B)

Astronomy - II

Unit I Equation of time – Seasons – Convertion of time.

Unit II Moon – sidereal month, Lunation and relation between them – Phases of moon – Lunar Liberation - surface of moon – metonic cycle – Tides.

Unit III Eclipses – shadow cone – Minimum and maximum number of eclipses.

Unit IV Planetary Phenomena – Bode's law – Elongation – Sidereal period, synodic period and the relation between them – Phases – Stationary points – solar system.

Unit V Stellar Universe – A brief history of Astronomy. Astronomial instruments – Galaxies and constellations.

Text Book:

- S. Kumaravelu and Susheela Kumaravelu – Astronomy Rainbow Printers, Nagercoil (2005)

Books for Reference :

1. George - O - Abell – Exploration of the Universe (Second Edition)

MSU/2016-17/UG-Colleges/Part-IV (B.Sc. Mathematics) / Semester-VI/ Major Elective – III (C)

Mathematical Modelling

Unit I **(Mathematical modelling through O.D.E (First order))**
Linear growth and Decay models – Non-linear growth and Decay models – Compartment Models – Dynamics Problems – Geometrical Problems.

Unit II Population dynamics – Epidemics – Compartment Models – Economics, Medicine, Arms race, Battles and International Trade.

Unit III (**Mathematical Modelling through O.D.E. (Second order))**
Planetary motion – circular motion – Motion of satellites – Modelling through linear difference equations of second order.

Unit IV **(Mathematical Modelling through difference equations)**
Basic theory of difference equation with constant coefficients – Economics and Finance – Population dynamics and genetics – Probability theory.

Unit V **(Modelling through graphs)**
Solutions that can be modelled through graphs - models in terms of directed graphs, signed graphs – weighted digraphs and unoriented graphs.

Text Book:

- Kapur .J.N – Treatment as in "Mathematical Modelling" – New Age International Publishes, 2004.

Books for Reference :

1. Kapur .J.N – Mathematical Modelling in Biology and Medicine – East West Press – 1985.
2. Singh – Mathematical Modelling, International Book house – 2003.
3. Frank R. Giordano, Maurice D.Weir and William P. Fox, - A first course in mathematical modelling, Thomson Learning, London and New York, 2003.