St. Aloysius College (Autonomous), Jabalpur

Reaccredited 'A+' by NAAC (CGPA – 3.68/4.00)

College with Potential for Excellence by UGC

DST FIST Supported

Department of Mathematics

Syllabus

M.Sc. I to IV Semester

2019-20

CHOICE BASED CREDIT SYSTEM (CBCS)

(For PG Programme in Mathematics from the academic year 2019-2020 onwards)

1. Eligibility

(i) Admission: Candidates who have passed the qualifying examination (UG) with Mathematics shall be given in admission to M.Sc. Mathematics Degree Programme.

(ii) Degree : The candidates shall have subsequently undergone the prescribed course of study in the college affiliated to the University for a period of not less than two academic years, passed the examinations prescribed and fulfilled such conditions as have been prescribed.

2. Duration

The course is for a period of two years. Each academic year shall comprise of two Semester, viz. Odd and Even Semester. Odd semesters shall be from July to November and Even Semesters shall be from January to April. There shall be not less than 90 working days which shall comprises of minimum 375 teaching clock hours for each semester. (Exclusive of the days for the conduct of Odd and Even Semester examinations).

3. Programme

M.Sc. Mathematics

4. The CBCS System

The Programme will run on Choice Based Credit System (CBCS). It is an instructional package developed to suit the needs of students to keep pace with the developments in higher education and the quality assurance expected of it in the light of globalization in higher education.

5. Paper Offered

Semester I

	Paper	Title of the Paper
Core	I	Advanced Abstract Algebra- I
Core	II	Real Analysis-I
Core	III	Topology- I
Core	IV	Complex Analysis – I
Core	V	A. Functional Analysis – I
Elective		B. Integral Transform

Semester II

	Paper	Title of the Paper
Core	I	Advanced Abstract Algebra- II
Core	II	Real Analysis-II
Core	III	Ordinary and Partial Differential Equations
Core	IV	Complex Analysis – II
Core Elective	V	A. Number Theory
		B. Topology- II

Semester III

	Paper	Title of the Paper
Core	I	Operation Research – I
Core	II	Special Function
Core	III	A. Numerical Methods - I
Core Elective	IV	A. Programming in C
		B. Functional Analysis – II
Open Elective	V	A. Advanced Discrete Mathematics
		B. Mathematical Statistics

Semester IV

	Paper	Title of the Paper
Core	I	Operation Research – II
Core	II	Numerical Methods - II
Core Elective	III	A. Divergent Series
		B. Programming in C++
Core Elective	IV	A. Integration Theory
		B. Fuzzy Sets and Their Applications

Open Elective	V	A. Mathematical Modeling
		B. Wavelets

CVV- Comprehensive Viva-Voce

6. Details of the Number of Papers / Credits per Paper / No. of Hours in the PG Programme

Theory					
Semester	**No. of Papers**	**Credits per Paper**	**Total Credits**	**Total Hours per Week**	**Total Hours per Semester**
I	4 Core	5	25+ 1(Skill Development)= 26	5 x 6 = 30 Including Presentation for CVV	30 x 15 = 450
	1 E Core	5			
II	4 Core	5	25+ 1(Skill Development)= 26	5 x 6 = 30	30 x 15 = 450
	1 E Core	5			
III	4 Core	5	25+ 1(Skill Development)= 26	5 x 6 = 30	30 x 15 = 450
	1 Open Elec.	5			
IV	4 Core	5	25+ 1(Skill Development)= 26	5 x 6 = 30	30 x 15 = 450
	1 Open Elec.	5			

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER I: ADVANCED ABSTRACT ALGEBRA-I

CREDIT: 5
Max Marks: 40

Unit-1: Another Counting Principle, Conjugacy Relation, Normalizer of an element of a Group, Class Equation and its theorems, Cauchy theorem for Finite Group (both Abelian and Non-Abelian), Sylow's first and second theorem, Double Coset, Application of Sylow's third theorem in Finite Groups.

Unit-II: Series of Groups: Normal and Subnormal Series, Composition Series, Zassenhaus lemma, Schreir Refinement theorem, Jordon Holder theorem.

Unit-III: Solvable Group and its properties, Commutator Subgroup and its theorem, Nilpotent Group and its properties.

Unit-IV: Fields: Extension Field and its theorem, Finite Extension, Algebraic element and its theorem, Algebraic and Transcendental Extension, Roots of Polynomials, Remainder theorem, Factor theorem, Splitting filed and its theorems.

Unit-V: More about Roots: Derivative of a Polynomials and its theorems, Simple Extension and its theorems, Primitive element, Separable and Inseparable Extension, Perfect Field and its theorems, Finite Field and its theorems.

Text Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975 (For Units I, III, IV,V).
2. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999 (For Unit-II).

Reference Books:

1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Ed.) , Cambridge University Press, Indian Edition, 1997.
2. I.S. Luther and I.B.S. Passi, Algebra, Vol. I, Groups, Narosa Publishing House, 1996.
3. Surjeet Singh and Quazi Zameeruddin, Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
4. N. Jacobson, Basic Algebra, Vol. I & II, Hindustan Publishing Company, 1980.
5. S. Lang, Algebra, 3rd Edition, Addition-Wesley, 1993.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER II : REAL ANALYSIS - I

CREDIT: 5
MAX MARKS: 40

Unit-I: Definition and existence of Riemann-Stieltjes integral and its Properties, Integration and differentiation, The fundamental theorem of Calculus.

Unit-II: Integration of vector-valued functions, Rectifiable curves. Rearrangements of terms of a series. Riemann's theorem.

Unit-III: Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem.

Unit-IV: Power series, uniqueness theorem for power series, Abel's and Tauber's theorems.Functions of several variables, linear transformations.

Unit-V: Derivatives in an open subset of Rn, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem.

Text Book: Water Rudin, Principles of Mathematical Analysis, McGraw Hill, 1978.

Reference Books: 1. T.M. Apostal, Mathematical Analysis, Narosa.

2. H.L. Royden, Real Analysis, Macmillan (Indian Edition).

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER III: TOPOLOGY-I

CREDIT: 5
MAX MARKS: 40

Unit –I: Countable and uncountable sets. Infinite sets and Axioms of Choice, Schroeder-Bernstein theorem, Zorn's lemma, Well-ordering theorem. (As given in chapter -1, Article No. 1.7, 1.9, 1.10 of J. R. Munkre's book)

Unit – II: The definition and some examples of topological space, Topological Subspaces, limit point, derived set, Elementary concepts of open sets, closed sets, closure of a set, dense set, everywhere dense and nowhere dense set. Neighbourhood of a point on a set in a topological spaces, open base, isolated point of a set, Interior and boundary of a set.

Unit – III: Continuous maps and homeomorphism of topological spaces, an open base and open sub-base for topological space (As given in the Chapter-II of G.F. Simmons Book)

Unit – IV: First and Second Countable spaces, Lindelof's theorems, Separable spaces (As given in the Chapter-III of G.F. Simmons Book)

Unit – V: Disconnected and Connected sets and spaces, Connectedness on Real line, Components, totally disconnected spaces, Locally connected spaces (As given in the Chapter-VI of G.F. Simmons Book)

Text Book:

1. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.
2. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.

Reference Books:

1. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd, New Delhi.
2. I. Kelly, General Toplogy, Van Nostrand, New York, 1995.
3. K. Chandra Shekhara Rao, Topology, Narosa Publications.
4. J. P. Chauhan and J. N. Sharma, Krishana Publications.
5. S. S.Schaum series General Topology.

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS) JABALPUR
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College with Potential for Excellence (CPE) by UGC

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR

DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER

CORE PAPER IV: COMPLEX ANALYSIS I

CREDIT 5
MAX MARKS : 40

Unit-I: Complex integration, Rectifiable arcs, Contours, Complex line integrals, Evaluation of some integrals by direct definition, Complex integral as sum of two real line integrals, The absolute value of a complex integral, The Elementary form of Cauchy's Theorem, Extension of the Cauchy's Theorem.

UNIT-II: Cauchy integral formula,Cauchy's Integral formula for the derivative of an analytic function, Cauchy's Integral formula for Higher order Derivatives. Morera's theorem, Cauchy's inequality theorem, Liouville's theorem, Taylor's theorem.

UNIT-III: Laurent Theorem, Singularities, Poles and zeros of a Meromorphic function, The argument principle, Rouche's theorem,The fundamental Theorem of algebra, The maximum modulus principle, Schwartz lemma.

UNIT-IV: Residues, Cauchy's residue theorem, Evaluation of certain integrals, Integrals of type $\int_0^{2\pi} R(\cos\theta, \sin\theta)d\theta$, Integrals of type $\int_{-\infty}^{\infty} f(x)dx$, Integrals of type $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx\, dx$, $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx\, dx$, Case of poles on the real axis.

UNIT-V: Bilinear transformations, Elementary Transformations, Product of two Bilinear transformations, The linear group, Cross Ratio, Preservation of Cross Ratio under Bilinear transformations, Two important families of circles, Fixed point of a Bilinear transformations, Normal form of a Bilinear transformation.

Books recommended:

Text Book:

J.B. Convey, Function of one complex variable, Springer-Verlag, 1980.

Reference Books:

1. S. Ponnuswamy, Foundation of complex analysis, Narosa Publishing House, 1997.
2. L.V. Ahlfors, complex analysis, McGraw Hill,1979.

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ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER

CORE ELECTIVE PAPER V(A) :FUNCTIONAL ANALYSIS - I

CREDIT: 5
MAX MARKS: 40

Unit-I: Normed linear spaces, Banach spaces and examples, Properties of Normed linear spaces, Basic properties of finite dimensional normed linear spaces.

Unit-II: Finite dimensional Normed linear spaces & Sub spaces, Equivalent norms, Riesz Lemma and Compactness.

Unit-III: Quotient space of normed linear spaces and its completeness.

Unit-IV: Bounded linear operators & continuous operators, Non-Linear spaces operators.

Unit-V: Linear functional, bounded linear functional, Dual spaces with examples.

Text Book:

Text Book:

3. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.
4. E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.

Reference Books:

1. R. E. Edward, Functional Analysis, Dover Publication, New York, 1995.
2. P. K. Jain, O. P. Ahuja and Khalil Ahmed, Functional Analysis, New Age International (P) Ltd. Publ.

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ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
FIRST SEMESTER

CORE ELECTIVE PAPER V(B) INTEGRAL TRANSFORM

CREDIT 5
MAX MARKS:40

Unit-I: Laplace Transform, Properties of Laplace Transform, Laplace Transform of Derivatives of function, Inverse Laplace Transform, Properties of Inverse Laplace Transform, Inverse Laplace Transform of Derivatives, Convolution theorem.

Unit-II: Application of Laplace Transforms to solution of differential equations, solution of initial value problem, Laplace's equations, Laplace wave equation. Application of Laplace Transforms in Heat Conduction equation.

Unit-III: Application of Laplace Transforms to Boundary Value Problems, Electric Circuits, and Application to Beams. Applications to Dynamics.

Unit-IV: The Fourier Transform, The complex Fourier Transform, Inversion Formula, Fourier Cosine and Sine transform properties of Fourier transforms, Shifting Property, Change of Scale Property, Convolution & Parseval's identity.

Unit-V: Fourier Transform of the derivatives, Fourier Integral Theorem, Riemann-Lenesgue Theorem. Finite Fourier sine & Cosine Transform, Inversion Operational and combined Fourier transform.

Books recommended:

Text Book:

1. J. K. Goyal & K. P. Gupta, Integral Transform, Pragati Prakashan, Meerut.
2. A. R. Vashishtha & R. K. Gupta, Integral Transform, Krishna Prakashan Media (P), Limited.

Reference Book:

1. I. N. Sneddon , Integral Transform, Tata McGraw-Hill, New York.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER I: ADVANCED ABSTRACT ALGEBRA-II

CREDIT: 5
MAX MARKS: 40

Unit-I: The element of Galois theory: Automorphism of a Field, Group of Automorphisms of a Field, Fixed field and its theorems, Normal Extension and its theorems, Fundamental theorem of Galois theory.

Unit-II: Introduction of Modules, Examples, General properties of Modules, Submodules and Direct Sum of Submodules, R-homomorphisms and Quotient Modules.

Unit-III: Finitely generated modules, Cyclic modules, Simple modules, Semi-simple modules, Schur's lemma, Free Modules, Rank of a Module.

Unit-IV: Noetherian and Artinian Modules: Examples and theorems, Ascending and Descending Chain Condition (ace and dcc), Noetherian and Artinian Rings, Examples, Hilbert Basis theorem.

Unit-V: Finitely Generated Modules over a Principal Ideal Domain, Fundamental Structure theorem of Finitely Generated Modules over a Principal Ideal Domain, Applications to Finitely Generated Abelian Groups.

Text Books :

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975 (For Units I).
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Ed.) , Cambridge University Press, Indian Edition, 1997 (For Units II, III, IV,V).

Reference Books:

1. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
2. I.S. Luther and I.B.S. Passi, Algebra, Vol. I, Groups, Narosa Publishing House, 1996.
3. Surjeet Singh and Quazi Zameeruddin, Modern Algebra, Vikas Publishing House Pvt. Ltd., 1990.
4. N. Jacobson, Basic Algebra, Vol. I & II, Hindustan Publishing Company, 1980.
5. S. Lang, Algebra, 3rd Edition, Addition-Wesley, 1993.
6. Ramji Lal, Algebra, Vol. I & II, Shail Publication, 2002.

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DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER II : REAL ANALYSIS - II

CREDIT: 5
MAX MARKS: 40

Unit-I: Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.

Unit-II: Integration of Non-negative functions. The General integral. Integration of Series, Reimann and Lebesgue Integrals.

Unit-III: The Four derivatives. Functions of Bounded variation. Lebesgue Differentiation Theorem, Differentiation and Integration.

Unit-IV: The LP-spaces, Convex functions, Jensen's inequality. Holder and Minkowski inequalities. Completeness of LP.

Unit-V: Dual of space when $1 \leq P < \infty$, Convergence in Measure, Uniform Convergence and almost Uniform Convergence.

Text Book: G. de Barra. Measure Theory and Integration, Wiley Eastern (Indian Ed.).

Reference Books:

1. Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill, International student edition.
2. H.L. Royden, Real Analysis, Macmillan, Indian Edition.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER III: ORDINARY AND PARTIAL DIFFERENTIAL EQUATION

CREDIT: 5
MAX MARKS: 40

UNIT I Exact differential equations and adjoints , The adjoint operator, Lagrange's identity , Strum-Liouville differential equation , Eigen values , The normal form, change of independent's variable, Lagrange's method of variation of parameters.

UNIT II Partial differential equation, Construction of partial differential equation of first order, Lagrange's linear equation, Charpit's general method of solutions, Green's functions, Domain and range of the operators, One dimensional Green's functions, Construction of Green's functions.

UNIT III Power series solution and special functions, A review of power series, Series solution of first order linear equations, Second order linear equations, Ordinary points, Regular singular points, Gauss's hypergeometric series.

UNIT-IV Laplace Transforms, Integral transforms, A few remarks on the theory, Conditions for the existence of Laplace transforms, Applications to differential equations.

UNIT-V Derivatives and intergrals of Laplace transforms, Convolutions and Abel's Mechanical problem. More about convolutions, The unit step and impulse functions.

Text Books:

1.G.F.Sinmons, Differential Equation with applications and Historical Notes, McGraw Hill international Editions, 1991(for Units IV&V)

2.B.P Parashar; Differential and Integral Equations, CBS publishers and Distributors Ltd. 1992(for Units I,II&III).

Reference Books:

1. H.T.H. Piaggio, An Elementary Treatise on differential Equations and Their Applications, Indian Reprint,1966.
2. E.A. Coddington, An Introduction, The Solution of Ordinary Differential Equations, Indian reprint.
3. B.L.Ince and I.N.Sneddon, The Solution of Ordinary Differential Equations,Longman.1987.
4. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill International Editions, 1957

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER IV : COMPLEX ANALYSIS II

CREDIT: 5
MAX MARKS :40

UNIT-1: Weierstrass factorization theorem, Gamma function, Euler's Gamma function, Properties of Gamma function, Gauss' Formula, Functional Equation, The Riemann Zeta function, Extention of Zeta Function, Riemann's functional Equation.

UNIT-II: Mittage-Leffler's theorem, Analytic Continuation, Uniqueness of Analytic Continuation, Power series Method of Analytic Continuation, Schwarz's Reflection Principal for Symmetric Region.

UNIT-III: Harmonic functions, Basic Properties of Harmonic Functions, Harmonic Conjugates, Mean-Valued Theorem for Harmonic Functions, Harmonic Functions on a Disc, Poisson Kernel, Proposition, Harnack's inequality.

UNIT-IV: Calculus of Residues, Evaluation of Certain integrals, Integrals of type Case of poles on the Real Axis (Indenting Method),Integrals of Many Valued Functions such as Za ,logZ, A Quadrant or a sector of a circle as the contour.

UNIT-V: Conformal mappings,Sufficient condition for w=f(z) to represent a Conformal Mapping,Necessary condition for w=f(z) to represent a Conformal Mapping, Certain type of transformations, Translation w=z+∝, rotation only ,Magnification only,Magnification and rotation both,Translation Magnification and Rotation, Rotation and Inversion.

Books recommended:

Text Book :

J.B. Convey, Function of one complex variable, Springer-Verlag, 1980.

Reference Books:

1. S. Ponnuswamy, Foundation of complex analysis, Narosa Publishing House,1997.

2. L.V. Ahlfors,complex analysis,McGraw Hill,1979.

3. E. C. Tichmarsh, The theory of functions, Oxford University, Press, London.

4. Dr. H.K.Pathak , Complex Analysis

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ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE ELECTIVE PAPER V(A) : NUMBER THEORY

CREDIT: 5
MAX MARKS: 40

Unit-I: Divisibility theory in integers: Division algorithm, Greatest common divisor, Euclidean algorithm.

Primes and their distribution: The fundamental theorem of arithmetic, the sieve of Eratosthenes, the Goldbach conjecture.

Unit-II: The theory of congruence: Basic properties of congruences, binary and decimal representations of integers.

Fermat's Little theorem and pseudoprimes, Wilson's theorem, the Fermat-Kraitchik factorisation method, Chinese Remainder Theorem.

Unit-III: Number-Theoretic Functions: $\varphi(n)$, $d(n)$, $\sigma(n)$, $\mu(n)$ and their properties, Mobius inversion formula, the greatest integer function, Euler' theorem.

Unit-IV: Primitive roots: The order of an integer modulo n, Lagrange's theorem, composite numbers having primitive roots, the theory of indices.

Euler's criterion, Legendre's symbol and its properties, Quadratic reciprocity Law.

Unit-V: Introduction to Cryptography: From Caesar cipher to public key cryptography, the Knapsack cryptosystem, an application of primitive roots to cryptography.

Numbers of special form: Mersenne primes and perfect numbers.

Certain Diophantine equations: $ax + by = c$, $x^2 + y^2 = z^2$, Fermat's Last Theorem (without proof)

Text book –

1. Burton, D.M., *Elementary Number Theory, 7th Edition*, MacGraw-Hill Education, 2010 .

Reference Books:

1. Niven I., Zuckerman, H.S. and Montogomery, H.L., *Introduction to Theory of Numbers, 5th Edition*, John Wiley & Sons, 1991.
2. Hardy, G.H., and Wright, E.M., *Introduction to Theory of Numbers, 4th Edition*, Oxford University Press, 1991.
3. Silverman, J.H., *A Friendly Introduction to Number Theory, 3rd Edition*, Pearson, 2009.
4. Robbins, N., *Beginning Number Theory, 2nd Edition*, Jones and Bartlett Publishers, 2006.
5. Chowdhury, K.C., *A First Course in Theory of Numbers*, Asian Books Pvt. Ltd., 2007.
6. Stewart, B. M., Theory of Numbers, The Mac-millan copany, 1964.
7. Kashy T. Elementary Number Theory, Elsevier Science and Technology Books.

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ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2019-20
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE ELECTIVE PAPER V(B): TOPOLOGY-II

CREDIT: 5
MAX MARKS: 40

Unit –I: Continuous functions and compact sets, Basic properties of Compactness, Compactness and Finite Intersection Property, Product of spaces, Projection maps, Tychonoff's theorem, Local compactness, Heine Boral theorem.

Unit – II: Separation: T_I –speces, Hausdorff spaces, Regular, Completely regular spaces and Normal spaces, their characterization and basic properties (As given in the Chapter-V of G.F. Simmons Book)

Unit – III: Urysohn's Lemma, Tietze extension theorem, one-point compactification, the stone-cech compactification, Urysohn Metrization theorem (As given in the Chapter-V of G.F. Simmons Book)

Unit – IV: Net's & Filters, Topology and convergence of Nets, Housdorffness & Nets, Compactness & Nets, Filters and Convergence, Ultra Filters and Compactness.

Unit – V: The fundamental group and covering spaces, Homotopy of Paths, The Fundamental Group, Homomorphism, Covering spaces, The Fundamental Group of the circle.

Text Book:

5. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.
6. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.

Reference Books:

6. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd, New Delhi.
7. J. L. Kelly, General Toplogy, Van Nostrand, New York, 1995.
8. K. Chandra Shekhara Rao, Topology, Narosa Publications.
9. J. P. Chauhan and J. N. Sharma, Krishana Publications.