ST. ALOYSIUS' COLLEGE

AUTONOMOUS

JABALPUR- 482001

MADHYA PRADESH, INDIA

CRITERION-1

CURRICULAR ASPECTS

Key Indicator – 1.1

Curriculum Design and Development

Metric No.: 1.1.2

The programmes offered by the institution focus on Employability/ Entrepreneurship/ Skill Development and their course syllabi are adequately revised to incorporate contemporary requirements

Document Name

Highlighted Program Curriculum Showing Employability/ Entrepreneurship/ Skill Development

PG Curriculum

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HIGHLIGHTED PROGRAM CURRICULUM SHOWING

LOCAL/REGIONAL/NATIONAL/GLOBAL NEEDS

EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

CROSS-CUTTING ISSUES

SYLLABUS

PG

MATHEMATICS

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS) JABALPUR
Re-Accredited 'A+' Grade by NAAC (CGPA 3.68)
College with Potential for Excellence (CPE) by UGC

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

To be implemented in 2023-24

CHOICE BASED CREDIT SYSTEM (CBCS)

(For PG Programme in Mathematics from the academic year 2023-2024 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	V	A. Number Theory
Elective		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	IV	A. Programming in C
Elective		B. Functional Analysis – II
Open	V	A. Advanced Discrete Mathematics

Elective		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
		C. Internship Project

CVV- Comprehensive Viva-Voce / Project Viva-Voce with maximum marks 100 and minimum marks 40.

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	5 x 6 = 30	30 x 15 =

	1 E Core	5	Development)= 26	Including Presentation for Viva-Voce	450
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

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER I: ADVANCED ABSTRACT ALGEBRA-I

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To make the students see and understand the connection and transition between previously studied mathematical concepts and more advanced mathematics.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 Provide the knowledge of important mathematical concepts in abstract algebra such as groups, Abelian groups, subgroups, cyclic groups, and normal subgroups of a group.

CLO2 Introduce many mathematical concepts such as Cauchy Abelian theorem, Sylow's theorems and various applications of Sylow's theorems.

CLO3 Confer knowledge of series of groups: Normal and Subnormal series, Composition series and their properties.

CLO4 Make the students participate actively in the vital concepts of abstract mathematics likeSolvable groups, Nilpotent groups and their characteristics.

CLO5 Appreciate the concepts of Extension field, Splitting field, Finite field, and related theorems.

Unit-I: 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 field and its theorems.

Unit-V: More about Roots: Derivative of a Polynomials and its theorems, Simple Extension and its theorems, Primitive element, Separable 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 2023-24
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER II :REAL ANALYSIS - I

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To make the students see and understand the connection and transition between previously studied Real analysis mathematical concepts and more advanced mathematics.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 The basic properties of the field of real numbers.

CLO2 The series of real numbers andconvergence.

CLO3 Provide the knowledge of Bolzano- Weirstrass theorem and ability to apply the theorem in a correct mathematical way.

CLO4 Introduce many mathematical concepts studied in Real mathematics such as the real functions

CLO5 limits, continuity, differentiability of real functions and its related theorems.

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 2023-24
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER III: TOPOLOGY-I

CREDIT: 5

MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To classify sets with various properties like finiteness, infiniteness, countability, unaccountability, etc.To present an introduction to the essentials of general topology with an emphasis on those aspects which are basic to higher mathematics.To stress on ideas of abstraction and aesthetics, development of mathematical tools and use of mathematical language.

COURSE LEARNING OUTCOME

Upon successful completion of this course, the student will be able to:

CLO1. Develop their abstract thinking skills.
CLO2. Understand the concept of cardinality.
CLO3. Gain knowledge of basic concepts of topology.
CLO4. Gain in mathematical maturity.
CLO5. Gain competency in writing proofs.

Unit –I: Equivalent Sets, Denumerable,Countable,infinite anduncountable sets.The Continuum, Schoreder-Bernstein theorem, Concept of cardinality, equivalence of $(0,1), (0,1], [0,1), [0,1]$,

Cantor's theorem and Continuum Hypothesis, Partially ordered sets, First and the last elements, Maximal & Minimal elements, upper and lower bounds, Zorn's Lemma, Axiom of Choice andWell-ordering principle. (As given in chapter -1, Article No. 1.7, 1.9, 1.10 of J. R. Munkre's book, chapter 3 of Seymour Lipschitz'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. Neighborhood of a point on a set in a topological spaces, isolated point of a set, Interior and boundary of a set. (Chapter 5- S.L. Book)

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, chapter 6-7, of Seymour Lipschitz's book)

Unit – IV: First and Second Countable spaces, Lindelof's theorems, Separable spaces (As given in the Chapter-III of G.F. Simmons Book, chapter 9 of Seymour Lipschitz's book)

Unit – V: Disconnected and Connected sets and spaces, Connectedness on Real line, Components, totally disconnected spaces, Locally connected spaces, Topologist's sine curve (As given in the Chapter-VI of G.F. Simmons Book, chapter 13 of Seymour Lipschitz's book)

Text Book:

1. Seymour Lipschitz, Theory and Problem of general Topology, Schaum Publishing co. N.Y., 1965.
2. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.
3. James R. Munkres, Topology, A First Course, Prentice Hall of India Pvt. Ltd. New Delhi.,1988.

Reference Books:

1. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd, New Delhi, 1983.
2. I. Kelly, General Toplogy, Van Nostrand, New York, 1995.
3. K. Chandra Shekhara Rao, Topology, Narosa Publications, 2009.
4. J. P. Chauhan and J. N. Sharma, Topology, Krishana Publications, 2015.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE PAPER IV: COMPLEX ANALYSIS -I

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

Understand complex numbers provide a satisfying extension of the real numbers, a function of complex variable and carry out basic mathematical operations with complex numbers.

COURSE LEARNING OUTCOME

On completion of syllabus student will be able to

CLO 1 – Understand the significance of differentiability for complex functions and be familiar with the Cauchy –Riemann equations.

CLO 2- Evaluate integrals along a path in the complex plane and understand the statement of Cauchy's theorem.

CLO 3- Compute the Taylor and Laurent expansions of simple functions, determining the nature of singularities and calculating residues.

CLO 4- Use the Cauchy Residue theorem to evaluate integrals and sum series.

CLO5 -Understand about Bilinear transformations, cross ratio and fixed points.

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 complexintegral,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'stheorem,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.

Text Book:

1. 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. M.L. Khanna, Complex Analysis
4. H.K. Pathak, Complex Analysis

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FIRST SEMESTER
CORE ELECTIVE PAPER V(A) :FUNCTIONAL ANALYSIS - I

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To get familiar with concepts of a normed linearspaces.To achieve knowledge and understanding of Banach spaces and their various properties. To give a working knowledge of the basic properties of Quotient spaces, bounded linear operators and functionals.To show the use of abstract algebraic/topological structures in studying spaces of functions.

COURSE LEARNING OUTCOME:

Upon successful completion of this course, the student will be able to:

CLO1. Appreciate how functional analysis uses and unifies ideas from vector spaces, the theory of metrics, and complex analysis.

CLO2. Work comfortably with Banachspaces.

CLO3. Understand normed linear spaces and theircompatibilities.

CLO4. Enhance the knowledge regarding Quotient spaces.

CLO5. Understand basic theorems including Hahn Banach Theorem.

CLO6. Acquire knowledge of bounded operators and functionals.

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: Definition and properties of cosets in normed linear spaces. Quotient space of normed linear spaces and its completeness.

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

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

Text Book:

1. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.
2. 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, 2004.

ST. ALOYSIS COLLEGE (AUTO.), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. SC. (MATHEMATICS) FIRST SEMESTER

CORE ELECTIVE PAPER V(B): INTEGRAL TRANSFORM

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

The course is aimed at exposing the students to Laplace and Fourier Transforms of different functions and their applications in solving Differential equations, Partial Differential equations, Initial Value and Boundary Value Problems.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO 1 Understand the Laplace Transform and Inverse Laplace Transform of standard functions.

CLO 2 Apply the appropriate shift theorems in finding Laplace and Inverse Laplace transforms of elementary functions.

CLO 3 Explain and apply to find the solution of Heat Conduction Equation, Boundary Value Problems and electric circuits. Also, they will be able to apply the Laplace Transform to beam and dynamics.

CLO 4 Evaluate the Fourier transform, Complex Fourier Transform, Fourier Sine transform and Fourier cosine transform of elementary functions.

CLO 5 Evaluate the Fourier Transform of the derivatives.

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.

Unit – IV:

The Fourier Transform, The complex Fourier Transform, Inversion Formula, Fourier Cosine and Sine transformproperties of Fourier transforms, Convolution &Parseval's identity.

Unit – V:

Fourier Transform of the derivatives, Finite Fourier sine & Cosine Transform,Inversion Operational and combined Fourier transform.

Books recommended:

Text Book:

1. J.K. Goyal& K. P. Gupta, Integral Transform, PragatiPrakashan, 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 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER I: ADVANCED ABSTRACT ALGEBRA-II

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

Give the students experience, knowledge, and confidence to move forward in the study of mathematics.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 Impart knowledge of some fundamental results and techniques from the Galoistheory.

CLO2 Analyze and demonstrate examples of modules and rings,

CLO3 Discuss general properties of Modules, Sub modules and Quotient module.

CLO4 Confer knowledge of Noetherian, Artinian modules and rings.

CLO5 Appreciate the concepts of finitely generated module over principal ideal domain and its application to finitely generated Abelian groups.

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 (acc 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 II, III, IV,V).

2. A.R.Vasishtha, Modern Algebra, Krishna Prakashan Mandir, Meerut (U.P.) (For Unit I).
3. 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.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER II :REAL ANALYSIS – II

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To make the students see and understand the connection and transition between previously studied length of sets concepts and more advanced length concept viz. Measure.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 The basic tools, concepts and results of measure theory and appreciate its importance in the wider context of mathematics.

CLO2 The knowledge of null sets, outer measure, measurable sets and Lebesgue measure, sigma-fields.

CLO3 Introduce many mathematical concepts studied in mathematics such as the Lebesgue integration, Fatou's Lemma, Monotone and Dominated Convergence Theorems.

CLO4 Understand the concept of Convex function and its geometrical representation

CLO5 Understand the concept of Dual space and convergence in measure

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 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER III:ORDINARY AND PARTIAL DIFFERENTIAL EQUATION

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To make the students see and understand the ordinary and partial differential equationand also different methods to solve differential equation at ordinary and singular points.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1. Understand ordinary differential equation and find the solution.

CLO2. Understandpartially differential equation and find the solution by various method.

CLO3. Apply power series method to solve differential equations.

CLO4. Evaluate Laplace transform of a function its inverse. Find the Laplace transform of derivatives, integrals and periodic functions.

CLO5. Apply Laplace transforms to solve initial-value problems for linear differential equations with constant coefficients.

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. lan Sneddon, Elements of Partial Differential Equations, McGraw Hill International Editions, 1957

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS) JABALPUR
Re-Accredited 'A+' Grade by NAAC (CGPA 3.68)
College with Potential for Excellence (CPE) by UGC

DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE PAPER IV :COMPLEX ANALYSIS II

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

Learn techniques of analysis that make practical problems easy (e.g. graphical rotation and scaling as an example of complex multiplication) **,** Appreciate how mathematics is used in design(e.g. conformal mapping).

COURSE LEARNING OUTCOME

Upon successful completion of this course, the student will be able to:

CLO 1 Perform basic algebraic manipulation with complex numbers
CLO 2 Understand the geometric interpretation of complex numbers
CLO 3 Know methods of finding the nth roots of complex numbers and the solutions of simple polynomial equations.
CLO 4 Use analytical functions and conformal mappings;
CLO 5 Compute definite integrals using residue calculus;

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

UNIT 3. 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 4. Calculus of Residues, Evaluation of Certain integrals, Integral of type Case of poles on the Real Axis(Indenting Method), Integrals of Many Valued Function such as Z^a , logZ, A Quadrant or a sector of a circle as the contour.

UNIT 5. 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 $w=z+\propto$, rotation only, Magnificationonly,Magnification and rotation both,Translation, Magnification and Rotation, Rotation and Inversion.

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

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE ELECTIVE PAPER V(A) :NUMBER THEORY

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To expose students Number Theory as a beautiful subject of Mathematics because of its treasure of fascinating problems and academic appeal.To understand the idea behind the famous quotation of Gauss on number theory.To allow students to experience mathematics as imaginative, empirical science.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1. Understand effective expression of concepts and results in number theory.

CLO2. Construct mathematical proofs of statements and explore counter examples to false statements.

CLO3. Understand the logic and techniques behind the major proofs in number theory.

CLO4. Gain perception of numerous applications in mathematics as well as in practical applications like cryptography of results from number theory.

CLO5. Attempt many unsolved problems in number theory.

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-Kraitchikfactorisation 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-millancopany, 1964.
7. Koshy T. Elementary Number Theory, Academic Press , 2007.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
SECOND SEMESTER
CORE ELECTIVE PAPER V(B): TOPOLOGY-II

CREDIT: 5

MAX MARKS: 40
MIN MARKS: 14

Course Objective:

To train the students in the area of topology.To give adequate knowledge of the subject that can be used by the students for further applications in their respective sphere of interest.

COURSE LEARNING OUTCOME

Upon successful completion of this course, the student will be able to:

CLO 1 Acquisition of knowledge in various topics of topology.

CLO 2 Appreciation of beauty of profound mathematical results such as Heine-Borel theorem and Urysohn's Lemma.

CLO3 Understanding the dynamics of methods of mathematical proof.

CLO 4 Understanding the Nets, Filters, Convergence, Ultra Filters and Compactness.

CLO 5 Understanding the fundamental group, covering spaces and Homotopy of Paths.

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_1 –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-cechcompactification, UrysohnMetrization 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:

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

Reference Books:

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

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2021-2022
M. Sc. (MATHEMATICS)
THIRD SEMESTER
CORE PAPER I: OPERATIONS RESEARCH -1

CREDIT: 5
Max. Marks 40
Min. Marks 14

COURSE OBJECTIVE:

The course aspires to make students understand, apply design and evaluate different types of Linear Programming Problems in Operations Research.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1: Comprehend the origin, development, characteristics, phases and applications of Operations Research.
CLO2: Design a LPP in real world objective and evaluate an optimal solution for the linear programming problem by graphical and simplex method
CLO3: Correlate LPP to its corresponding dual LPP and evaluate by simplex, two-phase and Big-M method.
CLO4: Frame and solve transportation problems.
CLO5: Analyze and evaluate replacement problems.

Unit-I: Operations Research and its scope. Origin and Development of Operations Research, Characteristics of Operations Research, Phase of Operations Research, Uses of Operations Research, Role of Operations Researchin Decision Making.
Unit-II: Linear Programming Problem, Mathematical Formulation of the Linear Programming Problem, Solution of LPP by Graphical method, Solution of LPP by Simplex method.
Unit-III: Solution of a Linear Programming Problem by Big-M method, Solution of LPP by Two phase method, concept of duality, Advantages of duality, Dual simplex method, Primal of dual Correspondence.
Unit-IV: Transportation problem, Initial basic feasible solution by North-West Corner Rule, Row Minima Method, Column Minima Method, Matrix Minima Method and Vogel's Approximation method, Optimality test by MODI method, Degeneracy in Transportation Problem, Unbalanced Transportation problem.
Unit-V: Replacement problem: Replacement Policy Theorem, Concepts: Money Value, Present worth factor discount, Replacement problem when money value is constant / money value changes with Time, Individual replacement, and Group replacement.

Text Books:

1. S.D. Sharma; Operations Research.

Reference Books:

1. K. Swarup, P. K. Gupta and Manmohan; Operations Research, Sultan Chand & Sons, New Delhi.
2. H. Hadley; Linear and Dynamic programming, Addison-Wesley Reading Mass.
3. F.S. Hiller and G.J. Lieberman; Industrial Engineering Series, 1995.

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS) JABALPUR
Re-Accredited 'A+' Grade by NAAC (CGPA 3.68)
College with Potential for Excellence (CPE) by UGC

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
THIRD SEMESTER
CORE PAPER II : SPECIAL FUNCTIONS

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To make the students see and understand the gamma, beta function and also hypergeometric, Bessel, Legendre and Hermite differential equations.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO 1 Explain the applications and the usefulness of thegamma and beta functions

CLO 2 Understand Hypergeometric function and their properties.

CLO 3 Gain the concept of Bessel differential equations along with the corresponding recurrence formulas of different functions.

CLO 4 Perform operations Legendre differential equations along with the corresponding recurrence formulas, orthogonal property of different functions.

Unit I Gamma and Beta Functions : The Euler or Mascheroni Constant γ, Gamma Function, A series for Γ' (z) / Γ (z) , Difference equation Γ(z+1) = zΓ(z), Euler's integral for Γ(z), Beta function, value of Γ(z) Γ(1-z), Factorial Function, Legendre's duplication formula, Gauss multiplication theorem, Relations between functions of z and 1 –z.

Unit - II Hypergoemetric and Generalized Hypergeometric functions: Function 2F1 (a,b;c;z) A simple integral form evaluation of 2F1 (a,b;c;z) Contiguous function relations, Hyper geometrical differential equation and its solutions, F (a,b;c;z) as

function of its parameters, Elementary series manipulations, Simple transformation,

Unit-III Bessel function , Definition of Jn (z), Bessel's differential equation, Generating function for Jn (z), Recurrence Relations for Jn (z), Bessel's integral with index half and an odd integer, Orthogonality of Bessel Functions .

Unit-IV Generating function for Legendre polynomials , Rodrigues formula, Bateman's generating function, Additional generating functions, Hypergeometric forms of Pn (x) , Special properties of Pn(x), Some more generating functions, Laplace's first integral form, Orthogonality.

Unit-V Hermite polynomial : Definition of Hermite polynomials Hn(x), Pure recurrence relations, Differential recurrence relations, Rodrigue's formula, Other generating functions, Orthogonality, Expansion of polynomials, more generating functions..

Books Recommended ;

1 Rainville, E.D, ; Special Functions, The Macmillan co., New york 1971,
2Srivastava, H.M. Gupta, K.C. and Goyal, S.P.; The H-functions of One and Two Variables with applications, South Asian Publication, New Delhi.
3 Saran, N., Sharma S.D. and Trivedi, - Special Functions with application, Pragati prakashan, 1986.

Reference Books.

1 Lebdev, N.N, Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New jersey, USA 1995.
2 Whittaker, E.T. and Watson, G.N., A Course of Modern Analysis Cambridge University Press, London, 1963.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
THIRD SEMESTER
CORE PAPER III : NUMERICAL METHODS I

CREDIT: 5
MAX MARKS: 40

MIN MARKS: 14

COURSE OBJECTIVE:

Understand the numerical methods and their analysis for solving different types of linear and non-linear systems.

COURSE LEARNING OUTCOMES:

Upon completion of the course, Students will be able to

CLO1 Solve Hermite Piecewise Interpolation, Piecewise Linear interpolation, Quadratic interpolation, Cubic Interpolation, Piecewise Cubic Interpolation using HermiteType Data.

CLO2 Understand Cubic Spline Interpolation, Bivariate Interpolation and Lagrange Bivariate Interpolation.

CLO3 Understand Euclidean Norm and Uniform for Discrete Data and Continuous Data,

CLO4 Find Least Square approximation, Legendre Polynomial and ChebeschevPolynomials Approximation.

CLO5 Understand Numerical Differentiation, Method Based on Interpolation and Method Based on Finite Differences.

UNIT – I :

Hermite Interpolation Piecewise Interpolation, Piecewise Linear Interpolation, Piecewise Quadratic Interpolation, Piecewise Cubic Interpolation, Piecewise Cubic Interpolation using Hermite Type Data, spline interpolation, Quadratic spline interpolation, Cubic spline interpolation, Natural Spline.

UNIT – II :

Bivariate interpolation, Lagrange Bivariate interpolation, Newton's Bivariate interpolation for Equispaced Points.

UNIT III :

Approximation,L^p Norm, Euclidean Norm and Uniform Normfor Discrete Data and Continuous Data, Least squares Aproximation, Gram-Schmidt Orthogonalizing Process, Legendre Polynomials, Chebyshev Polynomials.

UNIT IV : Uniform Approximation, Uniform (minimax) Polinomial Approximation(Chebyshev Approximation), Chebyshev Polynomials Approximation and Lanczos Economization, Rational Approximation , Choice of the method.

UNIT V : Numerical differentiation, Method Based on Interpolation, Non-uniform Nodal Points (Linear Interpolation,Quadratic Interpolation), Uniform Nodal Points (Linear Interpolation,Quadratic Interpolation), Method Based on Finite Differences, Method Based on Undetermined Coefficients, Optimum choice of step length.

Text Book :

Numerical Method for scientific and Engineering computation by M.K. Jain , S.R.K. Iyenger , R.K. Jain south Edition (2003) , New Age .

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
THIRD SEMESTER

CORE ELECTIVE PAPER IV(A):PROGRAMMING IN C

CREDIT: 5
MAX MARKS: 25
MIN MARKS: 09

COURSE OBJECTIVE:

The **course** is designed to provide complete knowledge of **C** language. Students will be able to develop logics which will help them to create programs, applications in **C**.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 Provide exposure to problem-solving through programming.

CLO2 Understand the fundamentals of C programming.

CLO3 Train the student to the basic concepts viz. conditional and decision making, file handling of the C-programming language.

CLO4 Understand the array and multi-dimensional arrays

CLO5 FindCommon Programming Error, Program testing and debugging.

Unit-1: An overview of programming languages ,Programmes development, functions Variables and Constants Expressions. Formatting sources files continuation character, the Processors.

Unit-2: Scaler data type-Declarations, different types of integers. Different kinds of Integer Constants Floating-point type Initialization, Mixing types, Explicit conversions-casts. Enumeration types. The void data type ,Typedefs.

Unit-3: Control flow-Conditional Branching, the switch statement. Looping. Nested Loops, the Break and Continue Statement. The Goto Statement Infinite Loops. Operators and Expressions-Precidence and Associatively. Unary plus and Minus operator. Binary, Arithmetic operator, arithmetic assignment operators. Increment and Decrement operator. Comma Operator, Relational Operators, Logical Operators bit-manipulation operators Bitwise assignment operators, size of operators, Conditional operators.

Unit-4: Array and multi dimentional arrays. Storage Classes-fixed vs. Automatic duration scope, global. The Register Specifier Structures and Unions, Pointers.

Unit-5: Developing a C Program: Introduction, Common Programming Error, Program testing and debugging, Program Efficiency. File management in C:Introduction, defining a file, closing a file, input/output operation On files, error handling during I/O operation.

Reference Books:

1. Samuel P.Harkison and Gly L Steels Jr.C:A reference manuel, II Edition ball 1984
2. Brain W Keringham& Dennis M Richie the C Programmed Language II edition(ANSI features)Prentice Hall 1989.

St. Aloysius' College (Autonomous), Jabalpur
M.Sc III Semester (Maths)
Programming In C (Program List) Practical

Max Marks: 15
Min Marks: 06

1. Write a program in C for swapping two numbers without using third variable.
2. Write a program in C to find the greatest among three number entered by user.
3. Write a program in C to check the entered integer is even or odd.
4. Write a program in C to check the entered alphabet is vowel or consonant.
5. Write a program in C to print days using switch case.
6. Write a program in C to find factorial of entered number.
7. Write a program in C to print the Fibonacci Series.
8. Write a program in C to check the entered integer is prime or not.
9. Write a program in C for addition of two matrices.
10. Write a program in C for multiplication of two matrices.
11. Write a program in C to print table of entered number.
12. Write a program in C to convert temperature from Fahrenheit to degree Celsius.
13. Write a program in C to check entered number is palindrome or not.
14. Write a program in C to convert decimal number to binary number.
15. Write a program in C to convert binary number to decimal number.
16. Write a program in C to sort elements using bubble sort method
17. Write a program in C to sort elements using selection sort method.
18. Write a program in C to search particular element in array.
19. Write a program in C to find the value of any number using pointer.
20. Write a program in C for finding biggest and smallest number in array, and find sum of the elements.
21. Write a program in C to find value of trigonometric function correct upto 4 decimal places.
22. Write a program in C to enter data in file.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
THIRD SEMESTER
CORE ELECTIVE PAPER IV(B) : FUNCTIONAL ANALYSIS - II
CREDIT: 5

MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

This course will cover the properties of Hilbert space including orthogonal complements, orthonormal set together with related identities and inequalities. Also the important notion of linear operator on a Hilbert space including adjoint operators, self adjoint operators and unitary operators will be dealt.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1 Have a knowledge of Hilbert space and its properties.
CLO2 Understand the concept of orthogonal complements, orthonormal set.
CLO3 Have a knowledge of Theory of linear operators, adjoint operators, self adjoint operators and unitary operators.
CLO4 Comprehend important theorems like the uniform boundedness theorem, open mapping theorem, closed graph theorem and Riesz representation theorem.
CLO5 Understand the concept of Projection, Normal and Unitary operators.

Unit-I: Uniform boundedness theorem and some of its consequences, open mapping and closed graph theorem, Hanh-Banach theorem for real linear spaces.

Unit-II: Hanh-Banch theorem for complex linear spaces and normaed linear spaces, Eeflixive spaces, Hilbert spaces, Orthonormal sets, Bessel's inequality.

Unit-III:. Complete orthonormal sets and Parseval's identity, Projection Mapping, Projection theorem.

Unit-IV: Structure of Hilbert spaces, Riesz representation theorem, Adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces.

Unit-V: Self -Adjoint operators, Positive Operators, Projection, Normal and Unitary operators.

Text Book:

1. G. F. Simmons, Topology and Modern Analysis , McGraw Hill International Edition, 1963.
2. 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.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
THIRD SEMESTER

OPEN ELECTIVE PAPER V(A) ADVANCED DISCRETE MATHEMATICS

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

The course aspires to make students understand, analyze and evaluate algebraic structures, lattices. Boolean algebra, graphs and trees

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO 1 Understand and analyze the basic principles and results of algebraic structures, semi groups, monoids and their properties.
CLO 2 Understand and reframe concept of different kinds of lattices
CLO 3 Understand and implement concepts of Boolean Algebra
CLO 4 Comprehend and apply different types of graphs and circuit in real life problems
CLO 5 Demonstrate different traversal methods for trees and graphs

Unit-I: Algebraic systems, semigroup, monoid, subsemigroup and submonoid definition and examples, direct product of semigroup, homomorphism and isomorphism of semi group, homomorphism and isomorphism of monoid.
Unit-II: Partial order relation, total order relation, partially ordered set- poset, chain, antichain, definition and examples, Hasse diagram, dual of a poset, homomorphism and isomorphism of a poset. Lattices as posets, lattices as algebraic systems, complete lattice, complemented lattice, bounded lattice, distributive lattice, dual of a lattice, sub lattices, definition, examples and general properties of a lattices, direct product of lattices, homomorphism and isomorphism of lattices.
Unit-III: Boolean lattice, Boolean algebra, definition, examples and general properties, principle of duality, sub Boolean algebra, direct product of Boolean algebra, homomorphism and isomorphism of Boolean algebra.
Unit-IV: Edges, incidence and adjacency of edges, vertex, degree of a vertex, even, odd, isolated and pendant vertex, simple graph, multi graph, regular graph, null graph, finite graph, infinite graph, digraph, planar graph, non-planar graph, complete graph, bipartite graph, definition and general properties, hand shaking lemma, isomorphic graphs, homeomorphic graphs, subgraph, vertex disjoint subgraph, edge disjoint subgraph, walk, path and circuit, labeled graph, weighted graph, shortest path in weighted graph, Dijkstra's algorithm, matrix representation of graphs and digraphs.
Unit-V: Connected graph, disconnected graph, components, minimally connected graph, definition and general properties. Tree, pendant vertex in a tree, internal vertex in a tree, distance and centers in a tree, radius of a tree, diameter of a tree, path length of a tree, rooted tree, binary tree, strictly binary tree, levels and height of a binary tree-definition and examples. Applications: Konigsberg bridge problem, utilities problem, Chinese postman problem and determining the longest monotonically increasing subsequence,

Text Books:

1. H. K. Pathak and J. P. Chauhan; Advanced Discrete Mathematics, Shiksha Sahitya Prakashan.
2. J. P. Tremblay & R. Manohar; Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.

Reference Books:

1. C. L. Liu; Elements of Discrete Mathematics, McGraw-Hill Book Co.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER
CORE PAPER I: OPERATION RESEARCH-II

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

The course aspires to make students comprehend, formulate, analyze and determine optimal solution to real life problems.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO 1 Formulate, solve and apply assignment problems so that cost is minimized.

CLO 2 Frame and evaluate job sequencing problems

CLO 3 Deduce the practicality of game theory and implement the techniques in real life perspective.

CLO 4 Develop a working knowledge of concepts and methods related to designing of networks, CPM-PERT, design, manage and complete projects in optimal time.

CLO 5 Understand the concepts of various inventory models, EOQ, multi items deterministic model and evaluate the cost involved therein. Control resource allocation and manage inventory.

Unit-I: Mathematical formulation of assignment problem, assignment algorithm, solution of assignment problem by Hungarian method, rules to draw minimum number of lines, unbalanced assignment problem, maximal assignment problem, traveling salesman problem.

Unit-II: Sequencing problem, Johnson's algorithm, idle time, elapsed time, processing n jobs on two machines, n jobs on three machines, n jobs on m machines, processing two jobs through m machines.

Unit-III: Two-person zero-sum game, maximin-minimax principle, games with/without saddle points, graphical solution of (2 x m) and (m x 2) games, principal of dominance, value of the game, optimal strategies.

Unit-IV: Introduction, historical development and applications of CPM and PERT, concepts, network diagram representation, Fulkerson's rule, backward pass computation, forward pass computation,total float, free float, independent float, network construction, CPM and PERT calculations, Project management by CPM and PERT.

Unit V: Inventory theory, types of inventory models, cost involved in inventory problems, variables in inventory problems, average inventory, concept of EOQ, economic lot size system with uniform and non-uniform demand, economic lot size with finite rate of replacement, production lot size model, multi-items deterministic models with one constraint, limitation on investment, floor space and inventory.

TEXT BOOKS:

1. S. D. Sharma; Operations Research.

REFERENCE BOOKS:

1. K. Swarup; P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.
2. H. A. Taha; Operations Research- An introduction, Macmillan Publishing Co. Inc. New York.
3. P. K. Gupta and D. S. Hira; Operations Research, an Introduction, S. Chand & Company Ltd. New Delhi.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER
CORE PAPER II: NUMERICAL METHODS II

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

The students will learn extrapolation methods and the mathematical theory of finite element methods.

COURSE LEARNING OUTCOMES:

Upon completion of the course, Students will be able to

CLO1 Understand extrapolation methods, Richardson's extrapolation and ordinary differential equations.

CLO2 Knowledge of multi step methods, explicit multistep methods and implicit multistep method.

CLO3 Solve boundary value problem with different conditions, linear second order differential equations by different methods.

CLO4 Understand Finite difference methods and Linear Second Order Differential Equation.

CLO 5 Understand finite element methods and linear Lagrange polynomial.

Unit 1 Extrapolation methods, Richardson's Extrapolation, Ordinary differential equations, Reduction of Higher order Equations to the system of first order Differential Equations, system of Linear first order Differential Equations with Constant Coefficients, Difference Equations.

Unit 2 Multi step methods,Explicit Multistep Methods, Adams-BashforthMethods(i=0), Nystrom Methods (i=1), Implicit Multistep Methods, Adams-Moulton Method (i=0),Milne-Simpson Method (i=1), Predicator and corrector methods, P $(EC)^m E$ Method, P $M_p C M_c$ Method**,** Stability analysis of multistep methods.

Unit 3 Ordinary Differential Equations:Boundary value problems, Initial Value Problem Method (Shooting method), Boundary conditions of the first kind, Boundary conditions of the second kind, Boundary conditions of the third kind.

Unit 4 Finite difference methods, Linear Second Order Differential Equation, Derivative Boundary Conditions, Fourth Order Method when u' is absent,Nonlinear Second Order Differential Equation u''=f(x,u), Newton-Raphson Method, Nonlinear Second Order Differential Equation u''=f(x,u,u').

Unit 5 Finite element method, Solution of the Variation Problem,RitzMethod,Finite Elements, Linear Lagrange Polynomial, Ritz Finite element method, Finite element Solution of Linear Boundary value problems, Assembly of element Equations, Mixed Boundary Conditions .

Text Book

Numerical Method for scientific and Engineering computation by M.K. Jain, S.R. K.Iyenger, R. K. Jain south Edition(2003), New Age.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER
CORE ELECTIVE PAPER III(B): PROGRAMMING IN C++

CREDIT: 5
MAX MARKS: 25
MIN MARKS: 09

COURSE OBJECTIVE:

The **course** is designed to provide complete knowledge of **C++** language. Students will be able to develop logics which will help them to create programs, applications in **C++**.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1. Comprehend the use of object-oriented concepts to implement object oriented programs in C++ with applications to encapsulation, inheritance and polymorphism.
CLO2. Develop knowledge of basic data structures for storage and retrieval of ordered or unordered data.
CLO3. Realize the applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching,
CLO4. Understand sorting of each data structure.
CLO5. Understand data base design normalization upto BCNF, distributive system– clouds.

Unit 1: object oriented programming, class and scope, nested classes, pointer class member class initialization, assignment and distribution.

Unit 2: over load function and operators templates including class templates, class inheritance and subtyping, multiple and inheritance.

Unit 3: data structure analysis of algorithm q, W, O, o, w notations, lists , stacks, and Queues, sequential and linked representation, tree, binary tree – search tree implementation, B – tree (concept only)

Unit 4: Hashing – open and closed, sorting:sort, shell sort, heap sort and their analysis.

data base system –role of data base system, data base system architecture.

Unit 5: Introduction to relational algebra and relational calculus. SQL-O basis features Including views, integrity constrains, data base design normalization upto BCNF, distributive system– clouds.

Reference books:

1B, stroustrup, the C++ programming language, Addison – Wesley.
2C.I date, introduction to data base system, Addison- Wesley.

ST. ALOYSIUS COLLEGE (AUTO.), JABALPUR
DEPARTMENT OF MATHEMATICS 2020-2021
M.Sc.(MATHEMATICS)
FOURTH SEMESTER
PRACTICAL – PROGRAMMING IN C++

MAX: 15 MIN: 6

1. Write a program in C++ language to define nested class.
2. write a program in C++ to implement multiple inheritance.
3. write a program in C++ for operator overloading.
4. write a program in C++ using function overloading to calculate area of circle, square and rectangle.
5. Write a program showing implementation of stack class having the functionality of push ,pop operations.
6. Write a program to implement a queue class with required operations/ functions.
7. Write a program to implementing linked list as a class. Also perform some required operations like inserting, deleting nodes.
8. Write a program in C++ Convert time from seconds to HH:MM:SS format using class.
9. Write a program in C++ to implement the Heap sort algorithm.
10. Write a program in C++ language for use of sort, shell sort, quick-sort.

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER

CORE ELECTIVE PAPER IV(B): FUZZY SETS AND

THEIRAPPLICATIONS

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

Provide an understanding of **the** basic mathematical elements of **the** theory of **fuzzy sets**. Provide an emphasis on **the** differences and similarities between **fuzzy sets** and classical **sets** theories.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1.	Understand the difference between crisp sets and fuzzy sets, Fuzzy membership function, types and operations of fuzzy sets and their properties.
CLO2.	Fuzzy numbers and fuzzy arithmetic.
CLO3.	Basic concepts of fuzzy relations, fuzzy graphs and fuzzy logic.
CLO4.	Knowledge of m fuzzy sets and intuitionistic fuzzy sets
CLO5.	Understand Fuzzy relations, Crisp v/s Fuzzy relations.

Unit-I: Support height nucleus of a fuzzy set, cardinality of a fuzzy set containment of two fuzzy sets, degree of subsethood, Fuzzy set, Membership function, Basic definition and concepts, Types of Fuzzy sets- normal subnormal fuzzy set, normalization α-cut set, strong α-cut, convex fuzzy set, necessary and sufficient condition for convexity of a fuzzy set,

Unit II: Operations on fuzzy sets, Union, Intersection, Complement of a fuzzy set, Decomposition of fuzzy sets, Cartesian Product, Algebraic product, Product of a fuzzy set with a crisp number, contract intensification and fuzzification Bounded sum and difference, t-norms, t-conorms, Power of a fuzzy set, Disjunctive sum of two fuzzy sets, examples.

Unit-III:Properties of fuzzy sets- commutative, associative, distributive, idempotent, identity, involution, De-Morgan's laws, and their proofs, equality of two fuzzy sets, examples.

Unit-IV: The Zadeh Extension Principle, Fuzzy numbers, Fuzzy arithmetic

Unit V: Fuzzy relations, Crisp v/s Fuzzy relations, Composite Fuzzy relation, Binary Fuzzy relations, Fuzzy equivalence relation,Fuzzy compatibility relation, Fuzzy relation equation, Similarity relations Fuzzy graphs.

Fuzzy logic- classical logic, multivalued logic, Fuzzy prepositions, Fuzzy quantifiers, Linguistic variables and Hedges, Inference from conditional Fuzzy preposition

Text Book-

1. G.J. Klir and Yuan, Fuzzy sets and Fuzzy Logic: The compositional rule of inference, Prentice Hall of India, New Delhi, 1995.
2. H.J. Zimmermann, Fuzzy set Theory and its Applications, Allied publishers Ltd, New Delhi 1991.

Reference Books:

1. Pundir and Pundir ,Fuzzy Sets and their Applications , Pragati Prakashan, Meerut, 2012
2. Timothy J.Ross, Fuzzy Logic with Engineering Applications, John Wiley & Sons, 2010

ST. ALOYSIUS COLLEGE (AUTO), JABALPUR
DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER
OPEN ELECTIVE PAPER V(A) MATHEMATICAL MODELING

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

The course aspires to make students understand and formulate mathematical models in real life situations

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO 1 Understand the concepts and techniques of mathematical modeling and its applications in real life situations.
CLO 2 Frame simple mathematical models with the help of differential equations and its application to evaluate linear growth and decay models.
CLO 3 Develop mathematical model through difference equations in finance, population dynamics and genetics.
CLO 4 Implement techniques and model situations through graphs.
CLO 5 Establish mathematical models via linear programming in forest management, transportation and assignment.

Unit I Simple situations requiring mathematical modeling, techniques of mathematical modeling, Classifications, Characteristics and limitations of mathematical models, Some simple illustrations.
Unit II Mathematical modeling through differential equations, linear growth and decay models, non-linear growth and decay models, Compartment models, Mathematical modeling in dynamics through ordinary differential equations of first order.
Unit III Mathematical models through difference equations, some simple models, and Basic theory of linear difference equations with constant coefficients, Mathematical modeling through difference equations in economic and finance, Mathematical modeling through difference equations in population dynamic and genetics.

Unit IV Situations that can be modeled through graphs. Mathematical models in terms of Directed graphs, Mathematical models in terms of signed graphs, Mathematical models in terms of weighted digraphs.

Unit V Mathematical modeling through linear programming, Linear programming models in forest management. Assignment and Transportation models.

Reference Books:

1. J. N. Kapur: Mathematical Modeling, Wiley Eastern.
2. D. N. Burghes: Mathematical Modeling in the Social Management and Life Science, Ellie
Herwood and John Wiley.
3. F. Charlton; Ordinary Differential and Difference Equations, Van Nostrand.

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DEPARTMENT OF MATHEMATICS 2023-24
M. Sc. (MATHEMATICS)
FOURTH SEMESTER
OPEN ELECTIVE PAPER V (B) : WAVELETS

CREDIT: 5
MAX MARKS: 40
MIN MARKS: 14

COURSE OBJECTIVE:

To expose the students to the basics of **wavelet** theory and to illustrate the use of **wavelet** processing.

COURSE LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

CLO1. Understand Fourier analysis
CLO2. Comprehend wavelets, orthogonal wavelets, wavelet series, linear phase filtering
CLO3. Identify orthogonal two-scale symbols.
CLO4. Understand the concept of Linear phase filtering, Compactly supported wavelets.
CLO5. Construction of Compactly supported orthogonal wavelets.

Unit I. Fourier Analysis: Fourier and inverse Fourier transforms, Convolution and delta function, Fourier transform of Square integrable functions. Fourier series, Basic Convergence Theory and Poisson's Summation formula.

Unit II. Wavelet Transforms and Time Frequency Analysis: The Gabor Transform. Short-time Fourier transforms and the uncertainity principle. The integral wavelet transforms Dyadic wavelets and inversions. Frames.

Unit III. Wavelet Series. Scaling Functions and Wavelets: Multi resolution analysis, scaling functions with finite two scale relations. Direct sum decomposition of L2 (R) .

Unit IV. Linear phase filtering, Compactly supported wavelets, Wavelets and their duals, Orthogonal Wavelets and Wavelet packets, Example of orthogonal Wavelets.

Unit V. Identification of orthogonal two-scale symbols, Construction of Compactly supported orthogonal wavelets, Orthogonal wavelet packets, orthogonal decomposition of wavelet series.

References:

1. C.K.Chui, A First Course in Wavelets, Academic press NY 1996.
2. I. Daubechies, Ten Lectures in Wavelets, Society for Industrial and Applied Maths, 1992.

SYLLABUS

PG

ENGLISH

St. Aloysius' (Autonomous) College,
Re-accredited 'A+' by NAAC (CGPA – 3.68/4.00)
College with Potential for Excellence by UGC
DST FIST Supported & STAR College Scheme by DBT
Jabalpur, (M.P) INDIA

Credit 05

Class	MA (Previous)		
Semester	I		
Paper	I (Core Paper)		
Title of the Paper	Poetry		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks

One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks
Course Outcomes:

1. Turn to writing poetry and experimenting with new trends.
2. The rhythm of poetry helps the students to acquire natural rhythm of speech and become better communicators.
3. Pleasure of literary forms such as novel, poem, drama, and essay.
4. Critical understanding and analyzing of literature.
5. Students can connect between literature and real life.
6. Emotional development of human mind.
7. Students will be able to read and translate poems in the other language known to them.

Unit-1	Elements of Poetry –How to approach Poetry, Figures of Speech: Imagery, Kinds of Images, Rhythm and Rhyme, Scansion of Poetry, Meter, Blank Verse, Free Verse, Iambic Pentameter
Unit-II	Epic Poetry: John Milton: Paradise Lost (Book -1) Valmiki : Ramayan (Sundarkand)) Poetry Hymns of Himalayas in Sundar Kand by Dr. Akhilesh Gumastha
Unit-III	Narrative Poetry: Geoffrey Chaucer: The Prologue to the Canterbury Tales

	S. T. Coleridge: The Rime of the Ancient Mariner
Unit-IV	Renaissance Poetry: William Shakespeare: Sonnets No. 23, 24, 26,27,31,44. John Donne: The Extasie, A Valediction Forbidden, Mourning, The Good Morrow, Love's Alchemie, Canonization, The Anniversarie.
Unit-V	Satirical Poetry: John Dryden: Absalom and Achitophel Alexander Pope: The Rape of the Lock

Books Recommended:

1. Emile Legouis- Chaucer

2. EMW Tillyard- Milton

3. Compton Rickett- History of English Literature

4. David Daiches- History of English Literature

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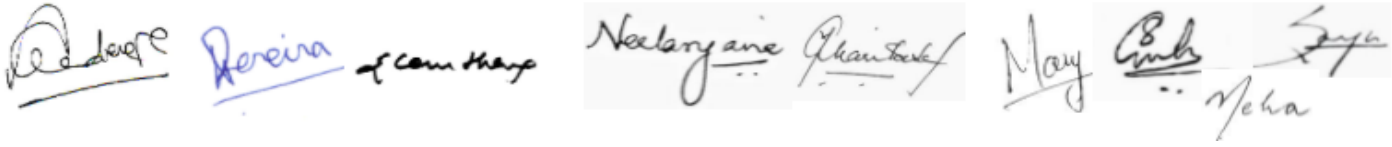
Credit 05

Class	MA		
Semester	I		
Paper	II (Core Paper)		
Title of the Paper	Drama		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks
Course Outcomes:

1. Demonstrate understanding of the social and artistic movements that have shaped theater and dance as we know it today
2. Analyze and interpret texts and performance both in writing and orally.
3. Practice collaborative skills in various theatrical contexts.
4. Demonstrate problem-solving skills in the creation of artistic work.
5. The practical exploration gets under-pinned by critical reflection.
6. The over-riding ethos is on reflective practice: making work, writing about it, watching work, and exploring different approaches practically rewarding.
7. Though the emphasis is on theater, there are opportunities to work through other media for students with appropriate experience and aspiration.

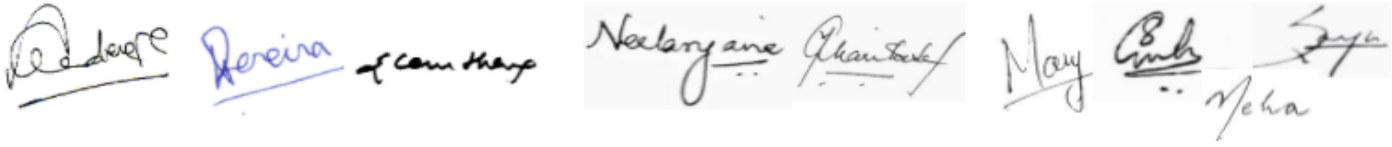
Unit-1	Brief History of English Drama; Elements of Drama; Interpretation of Drama.
Unit-II	Non- English Drama: Sophocles: Oedipus Rex Kalidas : Abhigyana Shakuntalam (English Translation , Sahitya Academi)



Unit-III	Shakespearean Tragedy: Hamlet King Lear
Unit-IV	Other Shakespearean Plays: Twelfth Night The Tempest
Unit-V	Renaissance Drama: (Non-Shakespearean) Christopher Marlowe: Dr. Faustus Ben Jonson : Every Man in His Humour

Books Recommended:

1. A. C. Bradley- Shakespearean Tragedy
2. H.B. Charlton- Shakespearean Comedy
3. Ram Vilas Sharma- Shakespearean Tragedy
4. Allardyce Nicoll- British Drama



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Credit 05

Class	M.A.		
Semester	I		
Paper	III (Core Paper)		
Title of the Paper	Fiction		
Marks	**Maximum Marks**	**Theory**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks
Course Outcomes:

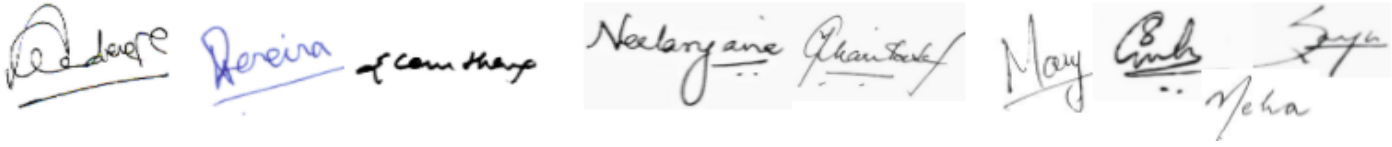
1. Students will be able to understand human psyche and respond better to day today situation/events backed by the fictional contexts explored.
2. Students will be able to recognize the conventions of different genres.
3. Students will develop interpretive arguments both in writing and discussion.
4. Students will understand the significance of historically underrepresented perspectives and traditions.
5. Students become masters of basic terms of literary study.
6. Students will attempt write fiction of publishable quality.
7. Students foster communication skills both in speaking and writing.
8. Students will be able to demonstrate a thorough command of English and its linguistic structures.

Unit-1	How to Study Novel: Plot, Character, Point of View, Setting, Dialogue, Early Prose Narrative. Bana Bhatt: Kadambari Cervantes: Don Quixote

Unit-II	Picaresque Novel: Henry Fielding: Tom Jones Daniel Defoe : Robinson Crusoe
Unit-III	Historical Novel: Walter Scott :Kenilworth Thackeray: Henry Esmond
Unit-IV	Fiction by Women: George Eliot: The Mill on the Floss Charlotte Bronte : Jane Eyre
Unit-V	19th Century Realistic Novel : Charles Dickens: Great Expectations. Zola: Nana

Books Recommended:

1. Walter Allen- History of English Novel
2. David Daiches- Critical Approaches to Literature
3. O.P Budholia- George Eliot: Art & Vision in her Novels
4. Ian Watt- The Rise of the Novel



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Credit 05

Class	M.A		
Semester	I		
Paper	IV (Core Paper)		
Title of the Paper	Prose		
Marks	**Maximum Marks**	**Theory**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
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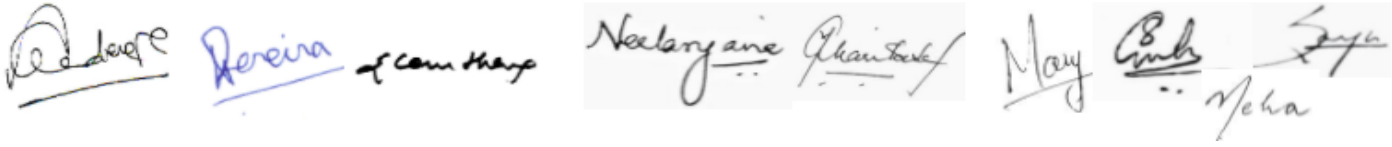
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks
Course Outcomes:

1. With focused extensive reading skills and orientation to various genres of prose, the learners can become competent content writers.
2. Improved creative and critical skills can lead to career options in publication houses as editors/copy writers.
3. Study of the nuances of non-fiction including voice, tone, themes, style and techniques in writing can make those interested in writing take up a career as a creative writers.
4. Narrative technique of writing would develop Report Writing Skills which would accommodate the candidates as Editors/ Reporters in newspapers.
5. The field of Translation may be explored.
6. Teaching Skills will be enhanced.

Unit-1	Interpreting prose: Stylistic Features : Figures of Speech, Tone, Emotion
Unit-II	Biography and Autobiography: Jawahar Lal Nehru: Autobiography (fourth chapter) Kamala Das: My Story (fourth chapter)



Unit-III	Political and Social Writings : Plato: The Republic, (Book II) (first four chapters) Francis Bacon: Of Truth, Of Studies, Of Revenge, Of Love
Unit-IV	Philosophical Writings: J. Krishnamurty: Individual and Society Action and Idea What is self? What are we seeking? Lala Hardayal : Intellectual Culture
Unit-V	Bertrand Russell: True Success William Hazlitt : The Ignorance of the Learned , The Indian Jugglers

Books Recommended:

1. Huge Walker- The English and its Essayists
2. Benson- The Art of Essay writing
3. J. Krishnamurty- The First and the Last Freedom

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Credit 05

Class	M.A.		
Semester	II		
Paper	I (Core Paper)		
Title of the Paper	Poetry		
Marks	**Total Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
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4. Critical understanding and analyzing of literature
5. Students can connect between literature and real life.
6. Emotional development of human mind.
7. Students will be able to read and translate poems in the other language known to them.

Unit I	Pre- Romantic Poetry: Thomas Gray: The Bard, The Progress of Poesy, Elegy Written in a Country Churchyard William Blake: On Another Sorrow, From Auguries of Innocence., The Poison Tree, The Tyger
Unit II	Romantic Poetry: W. Wordsworth: Tintern Abbey, Ode on Intimations of Immortality. P. B. Shelley: Ode to the West Wind, To a Skylark, The Cloud John Keats: Ode on a Grecian Urn, Ode to Autumn, Ode to Nightingale
Unit III	Victorian Poetry: Alfred Tennyson: Ulysses, The Lotos Eaters Matthew Arnold: Thyrsis, The Scholar Gypsy

Unit IV	Symbolist Poetry: T.S. Eliot: The Waste Land W.B. Yeats: The Second Coming, Byzantium, Sailing to Byzantium
Unit V	Modern Poetry: W. H. Auden: Strange Meeting, The Shield Of Achilles, The Unknown Citizen Dylan Thomas: Fern Hill, A Refusal to Mourn the Death of a Child

Books Recommended

1. Desmond King- *Shelley*- His thought and Work, Macmillan, London.
2. Graham Hough: The Last Romantics, Humphrey House: Coleridge,

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Credit 05

Class	M.A.		
Semester	II		
Paper	II (Core Paper)		
Title of the Paper	Drama		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
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3. Analyze and interpret texts and performance both in writing and orally.
2. Practice collaborative skills in various theatrical contexts.
3. Demonstrate problem-solving skills in the creation of artistic work.
4. The practical exploration gets under-pinned by critical reflection.
5. The over-riding ethos is on reflective practice: making work, writing about it, watching work, and exploring different approaches is practically rewarding.
6. Though the emphasis is on theater, there are opportunities to work through other media for students with appropriate experience and aspiration.

Unit I	Types of Drama: Tragedy, Comedy, Melodrama, Problem Play, Comedy of Errors; Comedy of Manners, Sentimental Comedy, Comedy of Character or Humours, Farce, Drama of Ideas, Didactic Drama, Tragic-Comedy, Symbolic Drama, Dance Drama, Mime and Absurd Theatre
Unit II	Restoration Drama: John Dryden: All for Love. Congreve: The Way of the World
Unit III	Victorian Drama: G. B. Shaw: Man and Superman

	Galsworthy: Justice
Unit IV	Modern Drama: Ibsen: A Doll's House Brecht: Mother Courage
Unit V	Indian Drama: Girish Karnad: The Fire and the Rain Mahesh Dattani: Tara

Books Recommended

1. Frederick Lumley: Trends in 20th Century Drama.
2. Allardyce Nicoll: British Drama,
3. Raymond Williams: Drama from Ibsen to Eliot.
4. O.P. Budholia: Critical Essays on Indian English Literature.

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Credit 05

Class	M.A.		
Semester	II		
Paper	III (Core Paper)		
Title of the Paper	Fiction		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
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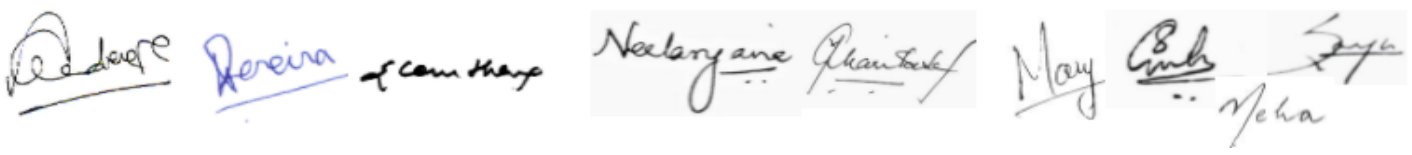
2. Students will be able to recognize the conventions of different genres.
3. Students will develop interpretive arguments both in writing and discussion.
4. Students will understand the significance of historically underrepresented perspectives and traditions.
5. Students become masters of basic terms of literary study.
6. Students will attempt write fiction of publishable quality.
7. Students foster communication skills both in speaking and writing.
8. Students will be able to demonstrate a thorough command of English and its linguistic structures.

Unit I	19th Century Fiction: Flaubert: Madame Bovary George Meredith: The Egoist
Unit II	Rural Novel: Thomas Hardy: Tess of the D' urbervilles Munshi Premchand: Godaan
Unit III	Psychological Novel:

	Virginia Woolf: To the Lighthouse D.H. Lawrence: Sons and Lovers
Unit IV	Naturalist Novel: Theodore Dreiser: Sister Carrie Stephen Crane: Maggie: A Girl of the Streets
Unit V	Post Naturalist Novel William Golding: Lord of the Flies Saul Bellow: Herzog

Books Recommended

1. Sisir Chattapadhyaya: The Technique of the Modern English Novel
2. A.S. Collins: English Literature of the 20th Century.
3. Arnold Kettle: An Introduction to the English Novel.
4. David Daiches: The Novel and the Modern World
5. Dorothy Van Ghent: The English Novel form and Function
6. Wilbur L. Cross: The English Novel
7. David Cecil: Early Victorian Novelists.
8. S.S. Narula: Galsworthy and the English Novel.



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Credit 05

Class	M.A.		
Semester	II		
Paper	IV(Core Paper)		
Title of the Paper	Prose		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

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1. With focused extensive reading skills and orientation to various genres of prose, the learners can become competent content writers.
2. Improved creative and critical skills can lead to career options in publication houses as editors/copy writers.
3. Study of the nuances of non-fiction including voice, tone, themes, style and techniques in writing can make those interested in writing take up a career as a creative writers.
4. Narrative technique of writing would develop Report Writing Skills which would accommodate the candidates as Editors/ Reporters in newspapers.
5. The field of Translation may be explored.
6. Teaching skills will be enhanced.

Unit I	James Boswell: The Life of Dr. Johnson (From Everyman's Edition of Boswell's Life of Dr. Johnson. London: J. M. Dent 1958 Vol. I, Introductory pp 5-11). Joseph Addison: On Ghosts and Apparitions, Fans
Unit II	Oliver Goldsmith: The Man in Black. Charles Lamb: New Year's Eve, A Bachelor's Complaint Against the Behavior of Married People, Dream Children: A Reverie
Unit III	A. G. Gardiner: On the Rule of the Road, In Defence of Laziness. Robert Lynd: Back to the Desk. Forgetting, The Pleasures of Ignorance, I Tremble to Think.

Unit IV	Twentieth Century Prose: Major Writers and Characteristics G. K. Chesterton: On Running after One's Hat, Patriotism and Sport. Hillary Belloc: On Books, On Preserving English.
Unit V	George Orwell: "Reflections on Gandhi" Virginia Woolf: "The Death of the Moth"

Books Recommended

1. R.P. Tiwari (ed): A.G. Gardiner: Selected Essays
2. Stuart Hodgson: A.G. Gardiner.
3. G.S. Fraser: The Modern Writer and His World.

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Credit 05

Class	M.A		
Semester	III		
Paper	I (Core Paper)		
Title of the Paper	Critical Theory		
Marks	**Maximum Marks**	**Theory Marks**	**Practical Marks**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5= 5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks

Course Outcomes:

1. Familiarity with origin of critical ideas in literature from Aristotle to present.
2. A better understanding of the function of criticism.
3. An enhanced historical sense in the field of Literature.
4. Students will develop critical thinking.
5. Will be able to apply ancient critical theories to contemporary texts.

Unit- I	Natyashastra- Rasa Theory The Poetics (Butcher's Translation)
Unit- II	Longinus- On the Sublime Philip Sydney- An Apology for Poetry
Unit- III	John Dryden- An Essay on Dramatic Poesy Johnson- Preface to Shakespeare
Unit- IV	Wordsworth- Preface to the Lyrical Ballads Coleridge- Biographia Literaria Ch. XIII & XIV
Unit-V	Mathew Arnold- Essays in Criticism (Second Series) T. S. Eliot- Tradition & Individual Talent

Books Recommended:

1. Kapil Kapoor: Critical Theory.
2. R.S. Pathak: Literary Theory.
3. Charusheel Singh: Literary Theory, Linear Configuration.
4. Butcher (tr): Aristotle's Poetics.
5. Scott James: The Making of literature.
6. David Daiches: Critical Approaches to English Literature.
7. H. Adams and L. Searle (ed.) Critical Theory since 1965 (Florida State University Press). A. H. Gilbert: Literary Criticism Plato to Dryden.

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Credit 05

Class	M.A		
Semester	III		
Paper	II (Core Paper)		
Title of the Paper	English Language		
Marks	**Maximum Marks**	**Theory Marks**	**Practical Marks**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks

Course Outcome

1. Trace the growth and development of English language
2. Get acquainted with the theories of language learning
3. Understand various approaches and methods to linguistics
4. Construct tests to measure language proficiency of learners.

Unit -I	Definition, Functions, Characteristics, Development of English Language.
Unit -II	Language Varieties: Register, Style and Dialect Approaches to the study of Language: Synchronic and Diachronic, Langue and Parole, Paradigmatic and Syntagmatic.
Unit -III	Definition of Phonetics & Phonology, Differences between Phonetics and Phonology, Organs of Speech.
Unit- IV	Phonemes, Allophones, Phonetic Symbols for Sounds in RP.
Unit -V	Basics of Transformational Generic Grammar: Nature and Characteristics.

Books Recommended:

1. Verma and Krishnaswamy: Modern Linguistics: An Introduction (O.U.P.1989)
2. A.C.Gimson: An Introduction to the Pronunciation of English.
3. R.K.Bansal and J.B.Harrison: Spoken English for India.
4. Geoffrey Leech: A Linguistic Guide to English Poetry (Longman. London 1969)
5. David Crystal: Linguistics (Penguin)

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Jabalpur, (M.P) INDIA

Credit 05

Class	M.A		
Semester	III		
Paper	III (Core Elective Paper)		
Title of the Paper	Indian Writing in English		
Marks	**Maximum Marks**	**Theory Marks**	**Practical Marks**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks

Course Outcome

1. The main objective of the course is to develop sensibility and emotions of students with the purpose to enable them to relish literature.
2. This course introduces students to a wide range of Indian Writing in English.
3. The students should be taught the prescribed texts with special emphasis on the issues such as the representation of culture, identity, history, national and gender politics, etc.
4. Knowledge of the making of the Indian idiom.
5. Familiarity with socio-cultural issues in colonial and Post-Colonial India with emphasis on the gradual evolution of the Indian mind-set from dependence on British writers to complete autonomy.

Unit- I	A Study of Indian English Literature: Literary Context, the Imitative, The assimilative, the experimental and contemporary phases.
Unit -II	Sri Aurobindo: Savitri- Book I Canto I. Tagore: Geetanjali- poems (1-10) (McMillan edition). 11-20 (for non-detailed) Contribution of Subhadra Kumari Chouhan to Indian Poetry
Unit -III	APJ Abdul Kalam- Wings of Fire Indian Autobiographies in English: An Overview (for short answers only)
Unit -IV	Girish Karnad: Nagamandala

	Vijay Tendulkar: Silence! The Court is in Session.
Unit- V	Anita Desai: Cry, the Peacock Arun Joshi: The City and the River Jhumpa Lahiri: The Unaccustomed Earth (selected stories non- detailed)

Books Recommended:

1. K.R.S.Iyengar : Indian Writings in English.
2. M.K.Naik : History of Indian English Literature.
3. M.K.Naik(ed) : Perspectives on Indian Drama in English.
4. Meenakshi Mukherjee : Twice Born Fiction.
5. Thompson : Tagore.
6. O. P. Budholia : Anita Desai: Vision and Technique in her Novels
7. M.K. Naik(ed.) : History of Indian English Literature

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Credit 05

Class	M.A		
Semester	III		
Paper	III (Core Elective Paper)		
Title of the Paper	American Literature		
Marks	**Maximum Marks**	**Theory Marks**	**Practical Marks**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 MarksCourse Outcome

1. The students will be acquainted with the literary terms of nineteenth century American Literature.
2. Learners will be introduced to the socio-cultural scene of nineteenth century America through literary texts.
3. Familiarity with the themes and styles of nineteenth century American Literature.
4. Ability to compare British, Indian and American writers and their works.
5. Understanding of the nuances of American English.

Unit- I	Brief History of American Literature: Major Writers and their Works
Unit –II	Prose: Emerson: Self Reliance, The Over Soul
Unit -III	Poetry: Walt Whitman: O Captain, My Captain, Song of Myself, Grass, When Lilacs last in the Dooryard Bloomed, I celebrate Myself. Robert Frost: Stopping by Woods on a Snowy Evening, After Apple Picking, Birches, The Road Not Taken.
Unit- IV	Drama: Eugene O' Neil: Mourning Becomes Electra.
Unit- V	Fiction: Mark Twain: Huckleberry Finn

Books Recommended:

1. History of American Literature by Goodman.
2. Walt Whitman by D. Dhawale
3. Cycle of American Literature by Robert Spiller.

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Credits: 05

Class	M.A		
Semester	III		
Paper	IV (Open Elective Paper)		
Title of the Paper	Fundamentals of Communication		
Marks	**Maximum Marks**	**Theory Marks**	**Practical Marks**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 1X5=5 Marks
One question from each unit
Part B: Five Short Questions
(Two question from each unit with internal Choice) 3X5= 15 Marks
Part C: Five Long Questions
(Two question from each unit with internal Choice) 4X5= 20 Marks
Course Outcomes:

1. The course covers most of the basic skills required for undertaking day-to-day personal and professional transactions using English as the medium of communication
2. The prescribed syllabus will help the students increase their proficiency in English by enhancing their resources to deal with communicative needs of everyday life at home, at work and in social interaction.
3. Ability to transfer information from non-verbal to verbal and vice and vice versa.
4. The course will cover development of LSRW.
5. Participation in social and professional communication.
6. Sensitivity of learners to cross-cultural differences.
7. Total shift in pedagogy from lectures oriented classes to interactive learning.
8. Students will be better equipped to understand the function of grammatical item used in spoken/written language.
9. Identifying general theories and central concepts associated with communication.
10. The material, methodology and language tasks create contexts for interaction and language use, so that learners acquire and sharpen their language skills as they process the texts on their own.

Unit- I	Introduction to Communication- Nature, Definition and Scope, Intent and Content of Communication
Unit –II	The Power of Non Verbal Communication, Para linguistics, Proxemics, What is NVC? Kinesics, The Face, Occulesics, Artifacts, Chronemics, Tactilics, Gesture, Neuro-linguistic Programming (NLP) and the Power of the Nonverbal.

Unit -III	Presentation Skills: Misconceptions, Preparation Structure, Delivering the Presentation, An Effective Presentation; Closing a Presentation, Handling Questions.
Unit -IV	Idioms, Proverbs, Quotations, Collocations and Usage: Introduction; Styles of idioms: Formal, Informal Slang, Collocations--- Position of Collocate in some Expressions 'Open and Restricted' set of collocates. Quotations: Function, Usage and Documentations.
Unit- V	Oral Communication: Dyadic: face to face, telephone, Interview: Public Speaking: Structuring of Contents, Audience Awareness, Time Management Speeches for Special Occasions, Developing Listening Skills: Hearing *vs* Listening's; Barriers to Listening.

Books Recommended

1. Oberg, B.C. Interpersonal Communication
2. Gimson, A.C. An Introduction to the Pronunciation of English.
3. Central Institute of English & Foreign Languages, Hyderabad
4. O' Connor. Better English Pronunciation.
5. Central Institute of English & Foreign Languages, Hyderabad- Exercises in Spoken English Part-I Accent, Rhythm & Intonation.

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Credit 05

Class	M.A.		
Semester	IV		
Paper	I (Core Paper)		
Title of the Paper	Critical Theory		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:
Part A: Five Objective Questions (No Choice) 5X1 =5 Marks
One question from each unit
Part B: Five Short Questions (With Internal Choice) 5X3= 15 Marks
One question from each unit
Part C: Five Long Questions (With Internal Choice) 5X4= 25 Marks
One question from each unit

Course Outcome:

1. Familiarity with origin of critical ideas in literature from Aristotle to present.
2. A better understanding of function of criticism.
3. An enhanced historical sense in the field of Literature.
4. Students will develop critical thinking.
5. Will be able to apply ancient critical theories to contemporary texts.

Unit- I	Anand Vardhan : Dhwani Theory. Ferdinand Saussure : The Nature of Linguistic Sign.
Unit-II	I. A. Richards :Two Uses of Language J. C. Ransom : Concept of Structure and Texture of poetry
Unit- III	F. R. Leavis : Literary Criticism & Philosophy. J. Derrida : Structure , Sign and play in the Discourse of human Science
Unit- IV	Edward Said : Crises (The Scope of Orientalism) Basic Trends In Feminist
Unit-V	Practical Criticism – It will contain two passages : One in verse and the other in prose for Practical Criticism following the technique as illustrated in I. A. Richard's book on Practical Criticism ` and David Daiches` Critical Approaches`

Books Recommended:

1. Kapil Kapoor: Critical Theory.
2. R.S. Pathak: Literary Theory.
3. Charusheel Singh : Literary Theory , Linear Configuration.
4. Butcher (tr): Aristotle's Poetics.
5. Scott James: The Making of literature.

6. David Daiches: Critical Approaches to English Literature.
7. H. Adams and L. Searle (ed.) Critical Theory since 1965 (Florida State University Press).
8. A. H. Gilbert: Literary Criticism Plato to Dryden.
9. T. Eagelton: Literary Theory: AN Introduction (Blackwell, Oxford, 1983)

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Credit 05

Class	M.A.		
Semester	IV		
Paper	II (Core Paper)		
Title of the Paper	English Language		
Marks	**Max Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:

Part A: Five Objective Questions (No Choice) 5X1 =5 Marks

One question from each unit

Part B: Five Short Questions (With Internal Choice) 5X3= 15 Marks

One question from each unit

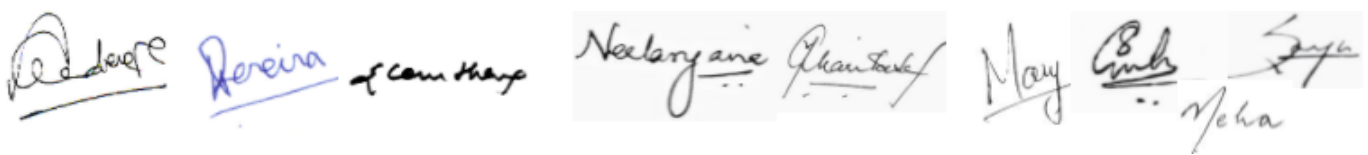
Part C: Five Long Questions (With Internal Choice) 5X4= 25 Marks

One question from each unit

Course Outcome

1. Trace the growth and development of English language
2. Get acquainted with the theories of language learning
3. Understand various approaches and methods to linguistics
4. Construct tests to measure language proficiency of learners.

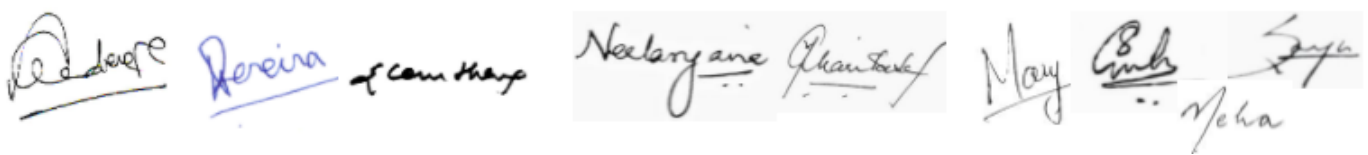
Unit -I	Morphology Morpheme, Allomorph, Word formation.
Unit -II	Linguistic Analysis, I. C. Analysis & Ambiguities.
Unit -III	Phonology Sound sequences: Syllable, Word Stress, Strong and Weak forms, Stress and Intonation.
Unit- IV	Grammar Sentence types and their transformation relations : (a) Statement (b) Question (c) Negative (d) Passive (e) Imperative.



Unit -V	Grammar Word classes: Noun Phrase, Verb Phrase, Adjunct Phrase, Syntax Coordination, Subordination, Relative Clauses, Adverbials, Determiners, Article Features, concord.

Books Recommended:

1. Verma and Krishnaswamy: Modern Linguistics: An Introduction (O.U.P.1989)
2. A. C. Gimson: An Introduction to the Pronunciation of English.
3. R. K. Bansal and J. B. Harrison: Spoken English for India.
4. Geoffrey Leech: A Linguistic Guide to English Poetry (Longman. London 1969)
5. David Crystal: Linguistics (Penguin)
6. Geoffrey Leech and Jan Svartvic: A Communicative Grammar of English



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Credit 05

Class	M.A		
Semester	IV		
Paper	III (Core Elective Paper)		
Title of the Paper	Indian Writing in English		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:

Part A: Five Objective Questions (No Choice) 5X1 =5 Marks

One question from each unit

Part B: Five Short Questions (With Internal Choice) 5X3= 15 Marks

One question from each unit

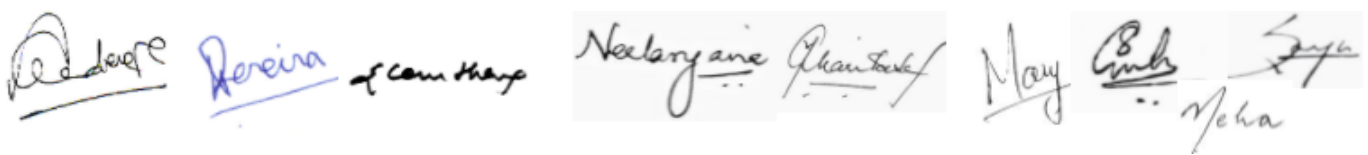
Part C: Five Long Questions (With Internal Choice) 5X4= 25 Marks

One question from each unit

Course Outcome:

1. The main objective of the course is to develop the sensibility and emotions of students with the purpose to enable them to relish literature.
2. This course introduces students to a wide range of Indian Writing in English.
3. The students should be taught the prescribed texts with special emphasis on the issues such as the representation of culture, identity, history, national and gender politics, etc.
4. Knowledge of the making of the Indian idiom.
5. Familiarity with socio-cultural issues in colonial and Post-Colonial India with emphasis on the gradual evolution of the Indian mind set from dependence on British writers to complete autonomy.

Unit- I	1. Indian Writings In English 2. Post-Colonial Indian Poetry In English 3. Sarojini Naidu 4. Kamala Das (all poems of each poet in V. K. Gokak ed. Golden Treasury of Indo – Anglian Poetry – Sahitya Academy)



Unit -II	M. R. Anand : Untouchable R. K. Narayan : The English Teacher
Unit -III	Vishnu Sharma : Panchatantra (Book I) Munshi Premchand: The Shroud (Kafan)
Unit -IV	Amitav Ghosh : The Shadow lines Shashi Deshpande: That Long Silence Arvind Adiga : The White Tiger (Prize Winning Indian Fiction Writer To The Present(Objectives)
Unit- V	Short Stories: Ruskin Bond: The Kitemaker Jhumpa Lahiri: Mrs. Sen (From *Interpreter of Maladies*) Chitra Banerjee: Clothes (*Arranged Marriages*)

Books Recommended:

1. K.R.S.Iyengar : Indian Writings in English.
2. M.K.Naik : History of Indian English Literature.
3. M.K.Naik(ed) : Perspectives on Indian Drama in English.
4. Meenakshi Mukherjee : Twice Born Fiction.
5. Thompson : Tagore.
6. O. P. Budholia : Anita Desai: Vision and Technique in her Novels

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Credit 05

Class	M.A		
Semester	IV		
Paper	III (Core Elective Paper)		
Title of the Paper	American Literature		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:

Part A: Five Objective Questions (No Choice) 5X1 =5 Marks

One question from each unit

Part B: Five Short Questions (With Internal Choice) 5X3= 15 Marks

One question from each unit

Part C: Five Long Questions (With Internal Choice) 5X4= 25 Marks

One question from each unit

Course Outcome

1. The students will be acquainted with the literary terms of nineteenth century American Literature.
2. Learners will be introduced to the socio-cultural scene of nineteenth century America through literary texts.
3. Familiarity with the themes and styles of nineteenth century American Literature.
4. Ability to compare British, Indian and American writers and their works.
5. Understanding of the nuances of American English.

Unit- I	Contemporary Trends in American Literature: Unique American Style, Effects of World War II, The naturalist period, the Modern period
Unit -II	Prose Emerson: American Scholar Thoreau : Civil Disobedience
Unit -III	Poetry: Emily Dickinson: Because I could not Wait for Death, I Taste a Liquor Never Brewed, Light in Spring, This is my letter to the World. Sylvia Plath: Daddy, Lady Lazarus, The Bee Meeting.
Unit- IV	Drama:

	Tennessee Williams : The Glass Menagerie Edward Albee: The Zoo Story.
Unit V	Fiction: Ernest Hemingway: The Old Man and The Sea Steinbeck: Of Mice and Men.

Books Recommended:

1. History of American Literature by Goodman.
2. Cycle of American Literature by Robert Spiller.

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Credit 05

Class	MA		
Semester	IV		
Paper	IV (Open Elective Paper)		
Title	Trends and Techniques of Effective Communication		
Marks	**Maximum Marks**	**Theory Marks**	**Internal Assessment**
	50	40	10

Scheme of Marks:

Part A: Five Objective Questions (No Choice) 5X1 =5 Marks

One question from each unit

Part B: Five Short Questions (With Internal Choice) 5X3= 15 Marks

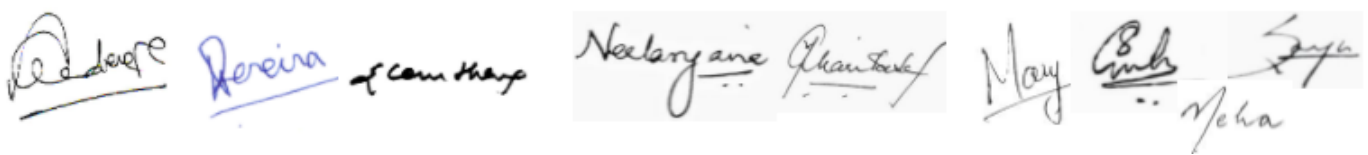
One question from each unit

Part C: Five Long Questions (With Internal Choice) 5X4= 25 Marks

One question from each unit

Course Outcomes:

1. The course covers most of the basic skills required for undertaking day-to-day personal and professional transactions using English as the medium of communication
2. The prescribed syllabus will help the students increase their proficiency in English by enhancing their resources to deal with communicative needs of everyday life at home, at work and in social interaction.
3. Ability to transfer information from non-verbal to verbal and vice and vice versa.
4. The course will cover development of LSRW.
5. Participation in social and professional communication.
6. Sensitivity of learners to cross-cultural differences.
7. Total shift in pedagogy from lectures oriented classes to interactive learning.
8. Students will be better equipped to understand the function of grammatical item used in spoken/written language.
9. Identifying general theories and central concepts associated with communication.



10. The material, methodology and language tasks create contexts for interaction and language use, so that learners acquire and sharpen their language skills as they process the texts on their own.

Unit - I	Mechanics of Manuscript Preparation: Editing and proof Reading Copy Editing. Words often confused Common Error Punctuations and Capitalization Abbreviation and Numerals
Unit - II	Literary Style and Professional Style. Features of Style Choice of Words and Sentences structure, Paragraph structure. Use of Figures of Speech: Function and Application
Unit -III	Academic Writings and Communication skills: What is Research? Plagiarism; Collecting Material; Primary and Secondary Sources. Hypothesis, Language of a Research Paper
Unit - IV	Communication in a Multicultural World: Idea of a Global World. Impact of Globalization and Multicultural Communication. What is Multiculturalism Etic and Emic Approach to Culture, Cross Cultural Communication Problems: Overcoming cultural Barrier
Unit- V	Keeping link with a changing world: The PR Way. Why Public Relation? Meaning and Definition of Public Relation, Essentials of Public Relation, Methods (Tools) of Public Relation Communication skills for Public relations. What is Press Release? How to handle a press conference. Realities of Public relations, Guidelines for Press Release.

Books Recommended

1. *Oberg, B.C Interpersonal Communication*
2. *Glimson, A.C. An Introduction to the pronunciation of English*
3. Central Institute of English and Foreign Language, Hyderabad
4. O' Connor, Better English Pronunciation

SYLLABUS

PG

COMMERCE

St. Aloysius' College (Auto.), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Management Concepts and Organization Behaviour**	
Paper Code:		**CC: 101**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	**School of Management Thought**: Scientific Process, human behavior and social system school; decision theory school; Quantitative and system school; Contingency theory of management; Functions of manager. **Managerial Functions**: Planning – Concept, significance, types ; organizing – concept, principles, theories, types of organization, authorities, responsibilities , power, delegation, decentralization; staffing; direction; coordinating; control-nature, process and techniques.
Unit 2	**Organizational behavior –** Concept and significance ; Relationship between management and Organizational behavior ; Emergence and ethical perspective; Attitudes; Perception ; Learning ; Personality ; Transaction analysis. **Motivation**: Process of Motivation ; Theories of motivation – need hierarchy theory, theory X and theory Y, two factor theory, Alderfer's ERG theory, Mc Cleland's learned need theory, Victor Vroom's expectancy theory , Stacy Adams equity theory.
Unit 3	**Group Dynamic and Team Development:** Group dynamics – definition and importance, types of groups, group formation, group development, group composition, group performance factors; Principle – centered approach to learn development. **Leadership:** Concept; Leadership styles; Theories – trait theory , behavioral theory, Fielder's contingency theory; Harsey and Blanchard's situational theory; Managerial grid; Likert's four systems of leadership.
Unit 4	**Organizational conflicts**: Dynamics and management; Sources, Patterns, levels, and types of conflict: Traditional and modern approaches to conflict: Functional and dysfunctional organizational conflicts; Resolution of conflict.
Unit 5	**Interpersonal and Organizational Communication**: concept of two – way communication ; communication process; Barriers to effective communication ; Types of organizational communication ; Improving communication ; Transactional analysis in communication . **Organizational Development**: Concept; Need for change, resistance to change; Theories of planned change; Organizational Diagnosis; OD intervention.

Suggested Readings

1. Shukla , Madhukar. Understanding Organisation : Theory and Practice in India . Prentice Hall New Delhi
2. Robbin Stephen P. Organizational Behavior Prentice Hall New Delhi

St. Aloysius' College (Auto.), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Managerial Economics**	
Paper Code:		**CC: 102**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	**Nature and scope of managerial economics:** objective of a firm, economic theory and managerial theory, managerial economist's role and responsibilities. **Fundamental economic concepts**- incremental principle, opportunity cost principle, discounting principle, equi-marginal principle.
Unit 2	**Demand analysis:** individual and market demand functions, law of demand, determinants of demand, elasticity of demand- its meaning and importance, price elasticity, income elasticity and cross elasticity, using elasticity in managerial decision. **Theory of consumer choice:** cardinal utility approach, indifference approach, revealed preference and theory of consumer choice under risk, demand estimation for major consumer durable and non-durable products, demand forecasting techniques.
Unit 3	**Production theory**: production function- production with one and two variable inputs, stages of production, economies of scale, estimation of production function, cost theory and estimation, economic value analysis, short and long run cost functions- their nature, shape and inter-relationship, law of variable proportions, law of return to scale.
Unit 4	**Price determination under different market conditions:** characteristics of different market structures, price determination in firms equilibrium in short run and long run under prefect competition, monopolistic competition, oligopoly and monopoly. **Pricing practices:** methods of price determination in practice, pricing of multiple products, price discrimination, and international price discrimination and dumping, transfer pricing.
Unit 5	**Business cycles:** nature and phases of a business cycle, theories of business cycles- psychological, profit, monetary, innovation, Cobweb, Samuelson and Hicks theories **Inflation:** definition, characteristics and types, inflation in terms of demand-pull and cost-push factors, effects of inflation.

Suggested Readings:

1. Baumol, William J: Economic Theory and Operations Analysis, Prentice Hall, London.
2. Baya, michael R: Managerial Economics and Business Strategy, McGraw Hill Inc. New York.
3. Chopra, O.P: Managerial Economics, Tata Mcgraw Hill, Delhi.
4. Varshney RL And Maheshwari KL: Managerial Economics, Sultan Chand And Sons, New Delhi
5. Dwivedi DN: Managerial Economics, Vikas Publishing House, New Delhi.

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Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Financial and Cost Accounting**	
Paper Code:		**CC: 103**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	**Introduction** –nature scope and importance of financial accounting, basic accounting concepts and conventions, Recognition of revenues and expenses, accounting cycle and accounting equations, GAAP and accounting standards – Indian and international. **Accounting books and final accounts**: journal, cash book, sales book, purchase book etc., preparation trial balance profit and loss account and balance sheet.
Unit 2	**Bank Reconciliation Statements**. Final accounts of non-profit organization. Valuation of goodwill and shares.
Unit 3	Accounting for issue and redemption of shares and debentures. **Final accounts of companies** – An overview.
Unit 4	**Cost accounting**: Meaning, importance and scope of cost accounting, elements of cost-material, labour and overheads costs, methods and type of costing, cost classification, cost sheet.
Unit 5	**Cost Ascertainment:** Unit Costing, Job costing, Process Costing, Contract Costing Differential costing, incremental costing, and product line costing. Reconciliation of cost and financial accounting

Suggested Readings:

1. Gupta,R.L., Advanced financial Accounting , S.Chand and Company,New Delhi.
2. Shukla M.C., and T.S.Grewal;Advanced Accountancy,S.Chand and company, New Delhi.
3. Dearden,J & S.K.Bhattacharya,Accounting for management , Vikas Publishing House, New Delhi
4. Monga J.R. Advanced financial Accounting, Mayur Paperbacks,Noida.
5. Beams,F.A. Advance Accounting ,Prentice Hall,New Jersey.

St. Aloysius' College (Auto.), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Finance Group**	
Paper Title:		**Financial Management**	
Paper Code:		**FE:01**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	**Financial Management:** Meaning, nature, scope of finance, Financial goal- profit v/s wealth maximization. **Finance functions:** investment, financing and dividend decisions.
Unit 2	**Capital Budgeting:** Nature and investment decisions, Investment evaluation criteria- net present value, internal rate of return, profitability index, payback period, accounting rate of return, NPV and IRR comparison, Capital rationing, Risk analysis in capital budgeting.
Unit 3	**Operating and Financial Leverage:** Measurement of leverages, Effects of operating and financial leverage on profit, Analyzing alternate financial plans, Combined financial and operating leverage. **Capital Structure Theories:** Traditional and M.M. hypothesis- without taxes and with taxes, Determining capital structure in practice.
Unit 4	**Cost of Capital:** Meaning and significance, Calculation of cost of debt, preference capita, equity capital and retained earnings, Combined Cost of Capital (weighted) Cost of equity and CAPM. **Dividend Policies:** Issues in dividend decisions, Walter's Model, Gordon's Model, M-M Hypothesis, dividend and uncertainty, relevance of dividend, Dividend policy in practice, Forms of dividends, Forms of dividends, Stability in dividend policy, Corporate dividend behavior.
Unit 5	**Management of Working Capital:** Meaning, significance and types of working capital, Calculating operating cycle period and estimation of working capital requirements, Financing of Working Capital and norms of bank finance, Sources of Working Capital, Factoring services, Various Committee re, Dimensions of Working Capital Management. **Management of Cash, receivables and inventory.**

Suggested Readings:

1. Chandra, Prasanna, Financial Management, Tata Mc Graw Hill, Delhi.
2. Pandey I.M., Financial Management, Vikas Publishing House, Delhi.
3. Khan M.Y., Jain P.K., Financial Management, Tata Mc Graw Hill, Delhi.
4. Van Horne J.C., Financial Management and Policy, Prentice Hall, Delhi.

St. Aloysius' College (Auto.) Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Finance**	
Paper Title:		**Financial Institutions and Markets**	
Paper Code:		**FE:02**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit-I	**Introduction**: Nature and role of financial system; Financial system and financial markets; Financial system and economic development; Indian financial system- an overview **Financial Markets**: Money and capital markets; Money market- meaning, constituents, functions of money market; Money market instruments- call money, treasury bills, certificate of deposits, commercial bills, trade bills.; Recent trends in Indian money market; Capital market- primary and secondary markets; Depository system; Government securities market; Role of SEBI- an overview; Recent developments
Unit-II	**Reserve Bank of India**: Organization, Management and functions; Credit creation and control; Monetary Policy **Commercial Banks**: Meaning, functions, management and investment policies of commercial banks; Present structure; E-banking and e-trading; Recent developments in commercial banking Development Banks: Concept, objectives and functions of development banks; Operational and promotional activities of development banks; IFCI, ICICI, IDBI, IRBI, SIDBI; State development banks, State financial corporations
Unit-III	**Insurance Sector**: Objectives, role, investment practices of LIC and GIC; Insurance Regulatory and Development Authority-role and functions **Unit Trust of India**: objectives, functions and various schemes of UTI; Role of UTI in industrial finance
Unit-IV	**Non-Banking Financial Institutions**: Concept and role of non-banking financial institutions: Sources of finance; Functions of non-banking financial institutions; Investment policies of non-banking financial institutions in India. **Mutual Funds:** Concept, performance appraisal, and regulation of mutual funds (with special reference to SEBI guidelines); Designing and marketing of mutual funds schemes; Latest mutual fund schemes in India-an overview
Unit-V	**Merchant Banking:** Concept, functions and growth; Government policy on merchant banking services; SEBI guidelines; Future of merchant banking in India **Interest Rate Structure:** Determinants of interest rate structure; Differential interest rate; Recent changes in interest rate structure **Foreign Investments**: Types, trends and implications; Regulatory framework for foreign investments in India

Suggested Readings:

1. Awadhani, Investment and Securities Markets in India, Himalaya Publications, Delhi.
2. Bhole, L.M.: Financial Markets and Institutions, Tata McGraw Hill, Delhi.
3. Averbach, Robert D: Money Banking and Financial Markets; MacMillan, London.

St. Aloysius' College (Auto.) Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Marketing Group**	
Paper Title:		**Marketing Management**	
Paper Code:		**ME:01**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit-I	**Introduction**: Concepts, nature, scope and importance of Marketing; Marketing Concepts and its evolution; Marketing Mix; Strategic Marketing Planning- An overview **Marketing Analysis and Selection**: Marketing environment- macro and micro components and their impact on marketing decisions; Market Segmentation and positioning; Buyer behavior; Consumer versus organizational buyers; Consumer decision making process
Unit-II	**Product Decisions**: Concept of a product; Classification of products; Major product; Product line and product mix; Branding; Packaging and labeling; Product life cycle-strategic implication; New product development and consumer adoption process.
Unit-III	**Pricing Decisions**: Factors affecting price determination; pricing policies and strategies; Discounts and rebates. **Distribution Channels and Physical Distribution Decisions**: Nature, Functions and types of distribution channels; Distribution Channel intermediaries; Channel management decisions; Retailing and Wholesaling
Unit-IV	**Promotion Decisions**: Communication process, Promotion mix- advertising, personal selling, sales promotion, Publicity and Public Relation; Determining advertisement budget; Copy designing and its testing; Media selection; Advertising effectiveness; Sales promotion-tools and techniques
Unit-V	**Marketing Research**: Meaning and scope of marketing; Marketing research process **Marketing Organization and Control**: Organizing and Controlling marketing operations **Issues and Developments in Marketing**: Social, ethical and legal aspects of marketing; Marketing of services; International marketing; Green marketing; Cyber marketing; Relationship marketing and other developments in marketing

Suggested Readings:

1. Ramaswamy V.S. & Ramakumari S., Marketing Management, MC Millan India, New Delhi.
2. Kotler Philip & Gary Armstrong, Principles of Marketing, Prentice Hall, New Delhi.
3. Majumdar Ramanuj, Product Management in India, Prentice Hall, New Delhi.

St. Aloysius' College (Auto.) Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Marketing Group**	
Paper Title:		**Advertising and Sales Management**	
Paper Code:		**ME:02**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	**Advertising:** Definition, advertising as a tool of marketing, Advertising effects- economic and social, Advertising and Consumer Behavior, Advertising Scene in India. Advertising Objectives and Advertising Budgets.
Unit 2	**Advertising Media:** Print Media, Broadcasting Media, Non-Media Advertising, Media Planning and Scheduling, Advertising on Internet, Media Selection decisions. Message Design and Development: Copy development, types of Appeal, Copy testing.
Unit 3	**Measuring Advertising Effectiveness:** Managing advertising agency- client relationship, Promotional scene in India, Techniques for testing Advertising effectiveness.
Unit 4	**Selling:** Concept, objectives and functions of Sales Management, Fundamentals of Selling, Selling Process, Salesmanship, Product and Customer knowledge **Sales Planning:** Importance, types, process, Sales Forecasting, Determining Sales territories, quotas and sales budget. **Sales Organization:** Setting up a sales organization, Principles of determining sales organization.
Unit 5	**Sales Force Management:** Estimating man power requirements for sales department; Planning for manpower recruitment and selection, training and development, placement and induction, Motivating and leading the sales force, Compensation and promotion policies, Sales meetings and contests. **Control Process:** Analysis of Sales Volume, costs and profitability, Managing expenses of Sales personnel, Evaluating sales force performance.

Suggested Readings:

1. Aaker, David, et. al.: Advertising Management, Prentice Hall, New Delhi.
2. Norris, James S.: Advertising, Prentice Hall, New Delhi.
3. Sengupta Subroto: Brand Positioning, Tata McGraw Hill, Delhi.
4. Patrick, Forsyth; Sales Management Handbook, Jaico Publication, Bombay.

St. Aloysius College (Autonomous), Jabalpur, M.P.

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Tax Procedure Group**	
Paper Title:		**Principles of Direct Taxes**	
Paper Code:		**TE:01**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Course Objective: The course will provide practical knowledge of income tax and will enable application of various provisions of income tax act for tax calculation. Upon the successful completion of this course, students will be equipped with the concepts of income tax laws in India.

Unit -1 Tax: Meaning, Features and objectives. Role of Taxes in Indian Economy. Direct Tax in India- General Introduction of Central, Provincial and Local Direct Taxes.

Unit -2 Income Tax: Characteristics and main features. Contribution of Income Tax in Public Revenue. Important definitions, Agriculture Income. Residential Status and Tax Liability. Exempted Income.

Unit -3 Computation of Taxable Income of Salaried persons. Exempted Items and Computation of Taxable Income in case of Retirement.

Unit -4 Computation of Taxable Income from House Property. Calculation of Taxable Income from Business and Profession. Provisions relating to calculation of Income on Estimated Basis of Small Traders, Contractors, Transporters and Professionals.

Unit -5 Capital Gains – Calculation of Taxable Capital Gain/Loss on Short Term and Long Term Capital Assets. Exemption for Capital Gains. Computation of Income from Other Sources.

Suggested Readings:

1. Shripal Saklecha & Anit Saklecha- -Direct Tax System- Income Tax (Satish Printers and Publishers)

2. Dr R K Jain- Direct Tax System- Income Tax (SBPD Publication)

St. Aloysius College (Autonomous), Jabalpur, M.P.

Course		**M.Com**	
Semester :		**I**	
Compulsory/ Elective:		**Elective**	
Group:		**Tax Procedure Group**	
Paper Title:		**Principles of Goods and Services Tax**	
Paper Code:		**TE:02**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Course Objective: To give the students a general understanding of the GST law in the Country. To provide them with a working knowledge of principles and provisions of GST. To provide an insight into practical aspects of GST and equip them to become tax practitioners.

Unit 1 **Introduction:** Meaning and features of Goods and Services (GST) background, necessity and implementation of GST, Impacts and difficulties of GST, Important terms and definitions under GST. Levy and collection of Tax.
Supply: Meaning and scope of Supply/ Tax liability on composite and mixed supplies. Time, Value and Place of Supply

Unit2 **Registration:** Registration under GST. Persons liable/ not liable for registration. Compulsory registration, process for Registration, Issue of Registration Number (GSTIN). Amendment and Cancellation of Registration.
Exemptions: List of Exempt Goods and Services under GST.

Unit 3 **Taxable Value of Goods:** Determination of Taxable Value of Supply of Goods by Manufacturers and Traders, Practical Problems.
Taxable Value of Services: Determination of Taxable Value of Supply of Services, Practical Problems.

Unit 4 **Input Tax Credit:** Provisions, procedure and rules for Input Tax Credit. (Practical Problem)
Job Work: Provisions regarding Job Work. Classification of Taxable Goods and Services on the basis of tax rates

Unit 5 **Composition Levy:** Composition levy – Persons eligible to opt for composition, Intimation for composition option. Conditions and restriction for composition, Rate of tax for the composition levy and rules regarding returns. Practical Problems relating to composition levy.
Accounts and Records: Provisions and Rules regarding Accounting Records, Manner of Maintenance of Records, Procedure for Generation and Maintenance of Electronic Records.

Suggested Readings:

1. Goods and Services Tax by Shripal Saklecha & Anit Saklecha - Satish Printers and Publishers
2. Goods and Services Tax by H C Mehrotra – Sahitya Bhawan Publication
3. Goods and Services Tax by CA Anoop Modi & CA Mahesh Gupta - SBPD Publication, Agra

St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Accounting for Managerial Decisions**	
Paper Code:		**CC:201**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	**Management Accounting:** Meaning, nature and importance. Difference of Management accounting with Cost Accounting and Financial accounting, Role and Duties of Management Accountant.
Unit 2	**Financial Statements** Nature and Limitations, Needs and objectives of financial Analysis, **Ratio Analysis**: Profitability, Turnover, Activity and Financial Ratios.
Unit 3	**Fund Flow** analysis and Cash Flow analysis, Application of Accounting Standard 3.
Unit 4	**Budgeting:** Budget and Budgetary Control, Types of budget. Nature and Characteristics of Long Terms Investment Decision, Methods of Ranking Investment Proposals by BEP Analysis.
Unit 5	**Management Reporting System**, Types of Reports, Responsibility Accounting, Concept of Management Audit. Standard Costing & Variance Analysis

Suggested Readings:

1. M.R. Agarwal – Accounting for Managers
2. Agarwal & Agarwal – Accounting for Managers
3. Agarwal, Jain & Jain – Management Accounting
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St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Corporate Legal Framework**	
Paper Code:		**CC:202**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	**The Companies Act, 2013:** Definition, types of companies, Memorandum of association; Articles of association; Prospectus; Share capital and Membership, Meetings and Resolutions; Company Management; Managerial Remuneration; Winding up and dissolution of companies.
Unit 2	**The Negotiable Instruments Act, 1881:** Definition, Types of Negotiable Instruments, Negotiation; Holder and holder in due course, Payment in due course; Endorsement and Crossing of cheque; Presentation of negotiable instruments.
Unit 3	**Competition Act, 2002:** Introduction, Features, duties and authorities of Competition Commission of India
Unit 4	**The Consumer Protection Act, 1986:** salient features; Definition of Consumer, Right of consumer; Grievance Redressal Machinery.
Unit 5	**Regulatory Environment for International Business;** FEMA, WTO: Regulatory framework of WTO, basic principles and its character, WTO provisions relating to preferential treatment to developing countries; regional groupings, technical standard, anti-dumping duties and other Non-Tariff Barriers. Custom valuation and dispute settlement, TRIP and TRIMS.

Suggested Readings:

1. Singh, Avtar: Law Relating to Monopolies, Restrictive and Unfair Trade Practices, Eastern Book Co., Lucknow.
2. The Companies Act, 2013
3. The Negotiable Instruments Act, 1881
4. SEBI Act, 1992, Nabhi Publication, Delhi.
5. Amarchand D, Government and Business, Tata McGraw Hill, New Delhi
6. Securities (Contract and Regulation) Act 1956
7. Jain Narang - Corporate Legal Framework

St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Compulsory**	
Paper Title:		**Statistical Analysis**	
Paper Code:		**CC:203**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Unit 1	Theory of Probability - Probability Distributions, Binomial, Poisson and Normal Distribution.
Unit 2	Theory of Sampling and Test of Signification.
Unit 3	Analysis of Variance (including one way and two way classification), Chi-square Test.
Unit 4	Interpolation and Extrapolation. Association of Attributes.
Unit 5	Correlation: Partial & Multiple, Regression Analysis, Statistical Decision Theory: Decision under Risk and Uncertainty, Decision Tree Analysis.

Suggested Readings:

1. Shukla & Sahai - Advanced Statistical Analysis
2. Gupta C.B - Advanced Statistical Analysis
3. Gupta B.N. - Advanced Statistical Analysis
4. Elhance D.N - Advanced Statistical Analysis
5. Pathak & Shashtri - Advanced Statistical Analysis
6. Singh U.N - Advanced Statistical Analysis
7. Nagar K.N - Advanced Statistical Analysis

St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Elective**	
Group:		**FINANCE**	
Paper Title:		**Investment Management**	
Paper Code:		**FE: 03**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	**Investment:** Nature and scope of investment analysis; Elements of investment- return, risk and time elements; Objectives of investment; Security return and risk analysis; Measurement of return and risk; Approaches to investment analysis.
Unit 2	**Types of Investments:** Financial investments- securities and derivatives, deposits, tax- sheltered investments; Non-financial investment- real estate, gold and other types and their characteristics; Sources of financial information.
Unit 3	**Fundamental Analysis:** Economics analysis, Industry analysis and company analysis. **Technical Analysis:** Various prices and volume indicators, indices and moving averages; Interpretation of various types of trends and indices.
Unit 4	**Stock exchange in India**: BSE, NSE, O.T.S.C., Interconnection of stock exchange in India, Stock Indices and their computation. SEBI - their powers and functions**.**
Unit 5	**Valuation of Fixed Income Securities:** Bonds, debentures, preference shares, and convertible securities. **Valuation of Variable Income Securities:** Equity shares.

Suggested Readings:

1. Prasanna Chandra- Investment analysis and portfolio management. (Tata Mcgraw Hill)

2. Donald E. Fisher and Ronald J. Jordan, Securities Analysis and Portfolio Management, Prentice Hall, New Delhi.

3. Sourain, Harry. , Investment Management, Prentice Hall of India.

4. Francis and Archer, Portfolio Management, Prentice Hall of India.

5. Gupta L.C., Stock Exchange Trading in India: Prentice Hall of India.

St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Elective**	
Group:		**FINANCE**	
Paper Title:		**Project Planning and Management**	
Paper Code:		**FE: 04**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	Project: Meaning, Characteristics and steps, Project Life Cycle, Causes of Project Failure. Classification of Project, Project Identification, Sources of Project Ideas, Considerations for Initial Selection of Projects
Unit 2	Project Formulation: Pre-feasibility Study, Project Feasibility Analysis: Market Analysis, Technical Analysis, Financial Analysis, Economic Analysis.
Unit 3	Project Finance: Direct Financial Assistance, Bridge Loans, Specific Assistance Scheme of Financial Institutions. Project Organization Structure, Role, Qualities and Functions of Project Manager, Rights and Responsibilities of a project manager.
Unit 4	Project Implementation: Pre-requisites for successful Implementation. Project Management Systems; Characteristics, Necessity, Project Management Information System.
Unit 5	Project Audit: Ex-post Project Evaluation, Human aspect of Project Management, Environment Appraisal of Projects (a brief review).

Suggested Readings:

1. N.P. Agarwal - Project Planning & Management
2. Prasanna Chand - Project Planning & Management
3. Chowdhri S.C - Project Planning & Management
4. Singh Narendra - Project Planning & Management
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St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Elective**	
Group:		**MARKETING**	
Paper Title:		**Consumer Behaviour**	
Paper Code:		**ME: 03**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	Introduction: Meaning and Significance of Consumer Behaviour, Determinants of consumer behaviour, Consumer behaviour Vs. Buyers Behaviour, Consumer Buying Process and Consumer Movements in India.
Unit 2	Organisational Buying Behaviour and Consumer, Research: Characteristics and Process of organizational, Buying Behaviour, Determinants of organizational buying behaviour. History of consumer research and Consumer Research Process.
Unit 3	Consumer Needs and Motivations: Meaning of Motivation, Needs and Goals, Dynamic nature of consumer motivation, Types and systems of consumer needs, Measurement of Motives and Development of Motivational Research.
Unit 4	Personality & Consumer Behaviour: Concept of Personality, Theories of Personality, Personality and understanding consumer Diversity, Self and self-images.
Unit 5	Social Class and Consumer Behaviour: Meaning of Social Class, Measurement of Social Class, Lifestyle profiles of the social class, Social class Mobility, Affluent and Non-affluent Consumer, Selected consumer behaviour applications in social class.

Suggested Readings:

1. Philip Kotler , Marketing Management

1. Schiffman, L.G. and Kanuk, L.L., Consumer Behavior, PHI

2. Loudon, D. and Bitta, D., Consumer Behaviour Tata Mc Graw Hill

3. Assael, H., Consumer Behaviour in Action, Cengage Learning

4. Blackwell, R.D., Miniard, P.W. and Engel, J.F.Consumer Behaviour, Thomson Learning

St. Aloysius' College (Autonomous), Jabalpur (M.P.)

Course		**M.Com**	
Semester :		**II**	
Compulsory/ Elective:		**Elective**	
Group:		**MARKETING**	
Paper Title:		**Strategic Marketing**	
Paper Code:		**ME: 04**	
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**4**

Unit 1	**Marketing Strategy and its Dimensions**: Concept of marketing strategy; Strategy content and process perspective; Marketing strategy–Performance relationship; Sustainable competitive advantage; Competitive marketing behavior; Comparative advantage theory of competition.
Unit 2	**Emerging markets strategies;** Rural marketing as a strategy; Concept of bottom of the pyramid marketing; Cause-related marketing; Green marketing strategy. **Market Orientation**: Market driven organizations; Market orientation–Concept and its linkages with performance, Different schools of thought; Internal market orientation; First mover advantage–Merits and demerits.
Unit 3	**Customer Relationship:** Customer relationship strategy– Role of trust, commitment and loyalty; Metrics for customer relationship marketing.
Unit 4	**Marketing: Marketing Capabilities And Investment**: Return on marketing investment; Brand marketing; Customer equity and brand equity; Customer engagement; Customer lifetime value (CLV); Customer referral value (CRV); Customer profitability analysis; Marketing analytics; Marketing capabilities.
Unit 5	**Emerging Issues In Strategic Marketing**: Service dominant logic of marketing; Co-creation of value; Co-opting customer competence; Concept of service innovation; Convergence marketing; Viral marketing; Social media marketing; Interactive marketing; Service-profit chain; Marketing strategies for Internet, mobile, telephone, debit/ credit card services

Suggested Readings:

1. Business policy and Strategic Management: Azar Kazmi

2. Strategic marketing: David W. Cravens, Nigel F. Piercy

3. Marketing Strategy, TMH Ed. – Boyd Walker, Mullins Larrec

St. Aloysius College (Autonomous), Jabalpur, M.P.

Class	M.Com
Semester	Second
Subject	Tax Procedure
Title of Paper	Income Tax Procedure & practice
Compulsory/Optional	(Optional) Paper-I
Minimum Marks	40

Course Outcome: The course will provide practical knowledge of income tax and will enable application of various provisions of income tax act for tax calculation. Upon the successful completion of this course, students will be equipped with the concepts of income tax laws in India and will be able to file Income Tax Returns.

Unit-I	Set-off & carry forward of losses, Clubbing of Income. Deduction from Gross Total Income. compulsory obligation gets Permanent Account Number(PAN),
Unit-II	Computation of Total Income of Individual and Tax Liability of Individual. Assessment of Hindu Undivided Family and Tax liability of HUF, Provisions and practical problems.
Unit-III	Assessment of Partnership Firm and Tax liability of Firm, Provisions and practical problems. Assessment of Company, Minimum Alternative Tax (MAT) & calculation of Tax liability of company and tax on Dividend.
Unit-IV	Assessment of Co-operative society & calculation of Tax liability of co-operative Society, Deduction of Tax at Source, Advance Payment of Tax. Provisions and rules relating to preparation of ITR, prescribed returns forms and furnishing in case of various categories of assesses. Filling and Filing of ITR Forms, Electronic forms
Unit-V	Tax Procedure of Assessment, Income Tax Administration. Tax Recovery and Refund, Appeal and Revision, Penalties and Prosecution

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Suggested Readings:

1. Shripal Saklecha & Anit Saklecha- -Income Tax Procedure & Practice (Satish Printers and Publishers)
2. Dr R K Jain- Income Tax Procedure & Practice (SBPD Publication)

St. Aloysius' College (Auto.), Jabalpur (M.P.)

Course		**M.Com**	
Semester:		**II**	
Compulsory/ Elective:		**Elective - Tax Procedure**	
Paper Title:		**Advanced Goods and Services Tax and Customs Duty**	
Paper Code:			
Max Marks	**Theory**	**Internal Assessment**	**Number of Credits**
50	**40**	**10**	**5**

Course Objective: To provide the students, advanced knowledge of the GST law in the country. To provide them with a working knowledge of principles and provisions of IGST. To comprehend the relevance of GST Returns and its contribution for economic development.

Unit 1	**Tax Invoice:** Meaning and features of Tax Invoices in Goods and Services (GST) Provisions relating to Tax Invoice proforma and procedure for preparing it. Practical Problems. **Debit & Credit Note:** Provisions regarding Debit Note and Credit Note. **E-way billing:** Provisions regarding generation, cancellation and Verification of E – way billing.
Unit 2	**Returns under GST:** Main Provisions and rules regarding Payment of Tax, Maintenance of Electronic Cash Ledger, Payment of Tax – Practical Problems. **Assessment under GST:** Provisions relating to Self, Provisional, Summary and Best Judgement Assessment. **Refund of Tax:** List of Exempt Goods and Services under GST.
Unit 3	**Payment of GST:** Main Provisions and rules regarding furnishing of Returns under GST Act, Types of Various Returns and related Forms – Monthly Return, Quarterly Return (Composition), Annual Return. **Scrutiny of Returns:** Procedure for Scrutiny of Returns. **Tax Audit:** Provisions and Procedure regarding Tax Audit, Tax Audit Forms
Unit 4	**Integrated Goods and Services Tax:** Scope of IGST. Important, Terms and Definitions under Integrated Goods and Services Tax, Act, 2017, Levy and collection of IGST, Principles for Determining the place of supply of goods and services, Zero rated supply. **Inspection, Search, Seizure and Arrest:** Powers for inspection, search and seizure, Inspection of Goods in movement, Procedure in respect of seized goods.
Unit 5	**Customs Duty:** Introduction and brief background of customs duty, Important definitions - Goods, Dutiable goods. Person In-charge, Indian customs water, types of customs duty Valuation for customs duty, items to be included and excluded in customs value, computation of Assessable value and Customs duty (Practical).

Suggested Readings:

1. Goods and Services Tax (Advanced Study) by Shripal Saklecha & Anit Saklecha - Satish Printers and Publishers
2. Goods and Services Tax and Customs Law by CA Anoop Modi & CA Mahesh Gupta - SBPD Publication, Agra.

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Compulsory**
Paper Title:		**Advance Income Tax**
Paper Code:		**CC:301**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Income Tax: Introduction and Important Definitions, Determination of Income from Salaries and Income from Salaries (Retirement): Income from House property: Determination and Property owned by co-owner, Unrealized Rent and Arrears of Rent. Interest of pre-construction period
Unit2	Income from Business or Profession: Determination of Income of certain business or profession on presumptive basis Depreciation. Capital Gains: Exempted Capital gains and Computation. Income from Other sources and Determination
Unit3	Clubbing of Income and Deemed Incomes, Set-off and Carry forward of Losses. Deduction from Gross total Income. Computation of Total Income of Individual and Tax Liability of Individual. Assessment of Hindu Undivided Family and Tax liability of HUF.
Unit4	Assessment of Partnership Firm. Assessment of Company, Minimum Alternative Tax (MAT) & calculation of Tax liability of company, Assessment of Co-operative society.
Unit5	Deduction of Tax at Source, Advance Payment of Tax, Tax Recovery and Refund, Form No. 16, 16A, 16B, Filing of Challan and Payment of Advance Tax. Tax Procedure of Assessment, Filling and Filing of ITR Forms, Income Tax Administration. Appeal and Revision, Penalties and Prosecution.

SuggestedReadings:

1. Student Guide to income tax, Sighania V.K. Taxman,Delhi
2. Income Tax Law & Practice, R. K. Gour & Narang, Kalyani Publisher, Mumbai
3. Income Tax R.B.D. Publishing House, Sharma, Shah, Agrawal, Mangal Jain & Modi, New Delhi
4. Income Tax Procedure & Practice, Satish Printers, Shripal Saklecha & Anit Saklecha
5. Income Tax Procedure & Practice, Sahitya Bhavan Publication, H.C. Mehrotra & S.P.Goyal
6. Income Tax Law & Practice, SBPD Publications, Dr. R.K.Jain

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Compulsory**
Paper Title:		**Business Environment**
Paper Code:		**CC:302**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Theoretical Framework of Business Environment: Concept, Significance and nature of business environment, Elements of environment - internal and external; Changing dimensions of business environment, Liberalization, Privatization and Globalization.
Unit2	Economic Environment of Business: Significance and elements of economic environment; Economic systems and business environment; Economic planning in India; Government policies. Industrial policy and licensing policy, fiscal policy, Monetary policy, EXIM policy.
Unit3	Problems of Growth: Unemployment; Poverty; Regional imbalances, Social Injustice; Inflation: Parallel Economy, Industrial Sickness.
Unit4	Socio, Cultural & International Environment: Social responsibility of business, Characteristic, Components, Scope, relationship between society and business, Socio-cultural business Environment, Social Groups, International Monetary Fund (IMF), Foreign Investment in India.
Unit5	Technological Environment: Concept, Online Channels, Online Services, Advantage of Online services, E-commerce, Indian conditions of Ecommerce, Electronic Banking, Franchise Business.

SuggestedReadings:

1. Adhikary, M: Economic Environment of Business, Sultan Chand & Sons, New Delhi
2. Ahluwalia, IJ.: Industrial Growth in India, Oxford University Press Delhi.
3. Alagh, Yoginder K: Indian Development Planning and Policy. Vikas Publication, New Delhi

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Compulsory**
Paper Title:		**Entrepreneurship, Innovation & Start-ups**
Paper Code:		**CC:303**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Introduction to Entrepreneurship: Entrepreneurs, entrepreneurial personality and intentions, characteristics, traits and behavioral, entrepreneurial challenges. Entrepreneurial Opportunities: Opportunities, discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.
Unit2	Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches. Effectuation and Causation.
Unit3	**Entrepreneurial Behaviour**: Innovation and Entrepreneurship, Social Responsibility. **Entrepreneurial Development Programme:** Entrepreneurial Development Programme relevance and achievements, role of Government in organising such programmes. Critical Evaluation.
Unit4	**Crafting business models and Lean Start-ups**: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups. Business Pitching.
Unit5	**Organizing Business and Entrepreneurial Finance**: Evolution of Organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus: Role of institutions in promoting entrepreneurship.

SuggestedReadings:

1. Rabindra N Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998
2. Peter F Drucker, Innovation and Entrepreneurship
3. EDI "Faculty and External Experts- A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development Institute of India, Ahmadabad, 1986.
4. Philips Bonefiel and Sharma (2011), Social Entrepreneurship, Global vision publishing house, New Delhi
5. Ries Eneeric(2011), The lean Start-up How constant innovation creates radically successful businesses, Penguin Books Limited
6. Blank Steve (2013), The Startup Owner's Manual The Step by Step Guide for Building a great Company K&S Ranch Carter and D. Jones-Evans,
7. Enterprise and small business- Principal Practice and Policy, Pearson Education (2006)

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Elective**
Group:		**FINANCE**
Paper Title:		**Portfolio Management**
Paper Code:		**FE:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Portfolio Management: Meaning Importance, objectives and various issues in Portfolio construction.Revision of portfolio and evaluation
Unit2	Portfolio Analysis: Estimating rate of return and standard deviation of portfolio returns, Effects of combining securities, Markowitz risk-return optimisation.
Unit3	Single Index Model: Portfolio total risk, Portfolio market risk and unique risk, Sharpe's optimization solution
Unit4	Capital Market Theory: Capital market line, Security market line; Risk free lending and borrowing, recent development Factor Models: Arbitrage pricing theory, principle of arbitrage, arbitrage portfolios; two factors and multi factors models
Unit5	Portfolio Construction: Techniques of Portfolio Construction Portfolio Performance Evaluation: Measure of return, risk adjusted measures of performance evaluation, market timing, evaluation criteria and procedures. Market efficiency: Concept, importance and status of Indian Capital Market.

SuggestedReadings:

1. Prasanna Chandra: Investment Analysis and Portfolio Management, McGraw Hill, Fifth Edition
2. Strong, Robert: Portfolio construction: Management and protection, prentice Hall, Delhi.
3. Barua, Raghunathan and Verma: Portfolio Management, TataMcGraw Hill, Delhi
4. Clark, James Francis: Investment- Analysis and Management, McGraw Hill, International Edition, New York
5. Fisher & Jordon: Security Analysis and Portfolio Management
6. Jack clark Francis: Management of Investments Mc Graw hill
7. Boltem: Security analysis and Portfolio Management

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Elective**
Group:		**MARKETING**
Paper Title:		**Service Marketing Management**
Paper Code:		**ME:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Introduction to Services Marketing: Importance of service sector, Nature and types of services, Difference between services and goods marketing, services marketing triangle. Services as a marketing concept: factors, for the growth of service sector; characteristics of services; dimensions of services; classification of services.
Unit2	Environment for services marketing: Macro and Micro Environment, Understanding service customers- Models of service consumer behavior, Customer expectations and perception, Service quality and Gap Model.
Unit3	Market Segmentation and Selection: Concept and importance Basis for market Segmentation, Service market Segmentation, Targeting and position. Market Information System, Marketing Research – Process and Significances
Unit4	Services Marketing Mix: Need for expanded marketing mix, Planning for service offer, Pricing, Promotion and distribution of service; Management of people, Process and physical evidence; Matching of demand for and supply of services.
Unit5	Service Marketing Applications: Marketing of financial, hospitality, hospital, tourism and educational services, International marketing of services and GATS.

SuggestedReadings:

1. Christopher H.Lovelock:Service Marketing:Prentice Hall:New Jersey.

2. Payne Adrian: The Essence of service Marketing, Prentice Hall,New Delhi.

3. Zeithaml, Gremler, Bitner, and Ajay Pandit, Services Marketing. Tata McGraw-Hill, 4th ed., 2008.

4. Lovelock, Services People, Technology and Strategy, Pearson Education, 5th ed., 2007.

5. Baron S and Harris K, Services Marketing: Text and Cases, Palgrave, 2003

6. Rajendra Nargundkar, Services Marketing: Text and Cases, Tata McGraw-Hill, 2nd ed., 2007.

7. Harsh V Verma, Services Marketing: Text and Cases, Pearson Education, 2008.

8. Rama Mohana Rao, Services Marketing, Pearson Education

9. Ramaswamy Marketing Management-Mc Graw Hill.

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Elective**
Group:		**TAX PROCEDURE**
Paper Title:		**Central, Provisional & Local Tax**
Paper Code:		**TE:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	General Study of Madhya Pradesh Excise Duty Act. Rates and calculation of duty collected on intoxicants issued from ware house, M.P. Excise Duty: Practical Problem
Unit2	Main provisions of Professional Tax, Persons Covered under Professional Tax, Rates of Professional tax and depositing liability, Practical Problems
Unit3	Types of Assets-Assets Management. Meaning of Ownership process to check the ownership on Asset. Meaning and Registration of Prakosht
Unit4	Registration of properties, Procedure or registration, Registration Authority, stamp duty on registration, Name transfer after registration Performa of agreement for Purchase-Sale of property, Performa of registry of property, Guideline Meaning importance procedure of determination of guideline, uses of guideline
Unit 5	Introduction of Municipal Tax, History, Object and types. Types of Local Taxes. Collection of Local Tax.

Suggested Readings:

1. Shripal Saklecha & Anit Saklecha, Various Provincial and Local Taxes, Sateesh Printer

St.Aloysius'College(Auto.),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**III**
Compulsory/Elective:		**Open Elective**
Paper Title:		**Human Resource Management**
Paper Code:		**OE:02**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Human resource management: concepts, perspectives, structure and role of human resource manager. Human Resource planning: Job analysis and job description. Recruitment and selection process, RPO (Recruitment Process Outsourcing).
Unit2	Socializing the new employee, employee training and development, performance evaluation and potential appraisal, Job evaluation, compensation and reward system.
Unit3	Knowledge Management: Introduction, Objective, Knowledge Resources, need for knowledge management, Processes and approaches and Case Study. Knowledge Process Outsourcing (KPO).
Unit4	Industrial Relation: Concept, approaches, importance, objective and principles of industrial relations. Trade Union Concept: Objectives, Significance, functions and types, problem of labor movements in India, Industrial Dispute Management.
Unit5	Industrial Psychology: Concept, functions and importance. Place of psychology in Industry. Group Dynamics: meaning, goals, characteristics, classification and advantages of group, Essentials of group formation, Group Cohesiveness: Managing group conflicts.

SuggestedReadings:

1. Udai Parikh, Oxford & IBH Publishing Co Pvt.Ltd, 3rd edition edition, 1 January 2017
2. Shashi K Gupta & Rosy Joshi, Kalyani Publishers
3. Gaurav and Sankalp. Sahitya bhavan Publication
4. G.S. Sudha, Ramesh Book depot, 2009
5. Bhagoliwal, Sahitya Bhawan publications

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Compulsory**
Paper Title:		**Indirect Tax: Goods and Service Tax**
Paper Code:		**CC:401**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Concept of indirect taxes- Concept and features of indirect taxes, Principal indirect taxes, Goods and Services Tax (GST) Law -GST Laws: An introduction including Constitutional aspects, Levy and collection of CGST and IGST. Application of CGST/IGST law, Concept of supply including composite and mixed supplies, Charge of tax, Exemption from tax, Composition levy
Unit2	CHARGE OF GST- Introduction, Relevant Definitions, Extent & Commencement of CGST Act/ SGST Act/ UTGST Act, Levy & Collection of CGST [Section 9 of the CGST ACT], Composition Levy [Section 10 of the CGST Act], Extent and Commencement of IGST [Section I of IGST Act], Levy & Collection of IGST [Section 5 of the IGST Act], EXEMPTIONS FROM GST- Introduction, Relevant Definitions, Power of Grant Exemption from Tax [Section 11 of the CGST Act/Section 6 of 1GST Act). Goods exempt from tax. List of Services exempt from tax.
Unit3	Time of Supply-Introduction, Relevant Definitions, Time of Supply of Goods [Section 12), Time of Supply of Services [Section 13] Value of Supply- Introduction, Relevant Definition, Value of Supply [Section 15] INPUT TAX CREDIT- Introduction, Relevant Definitions, Eligibility and Conditions for taking Input Credit [Section 16], Apportionment of Credit & Blocked Credits [Section 17], and Credit in Special Circumstances [Section 18], and How ITC is availed & utilized.
Unit4	Registration- Introduction, Relevant Definitions, Person Liable for Registration, Compulsory Registration in Certain Cases, Person not liable for Registration. Procedure for registration, Amendment of Registration, Cancelation of Registration and Revocation of Registration. Tax Invoice Credit and Debit Notes- Introduction, Relevant Definitions, Tax invoice, Credit & Debit note. Prohibition of unauthorized collection of tax.
Unit5	Payment of Tax- Introduction, Relevant Definitions, Payment of Tax, Interest, Penalty and Delay payment of Tax. Returns- Introduction, Relevant Definitions, Furnishing detail of Outward Inward Supplies, furnishing of returns, Special Returns, First Return,

SuggestedReadings:

1. Goods and Service Tax: Dr. H.C. Mehrotra & Prof V.P. Agrawal Sahitya Bhawan Publication
2. Goods and Service Tax: Sripal Saklecha & Anit Saklecha: Satish Printers
3. GST & Custom Law: CA Anoop Modi & CA Machesh Gupta: SBPD publication
4. Advance Goods and Service Tax: Sripal Saklecha & Anit Saklecha: Satish Printers

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Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Compulsory**
Paper Title:		**Research Methodology**
Paper Code:		**CC:402**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Introduction to Research Methodology: Meaning and importance of research, Types of research and research process, Identification of research problem and formulation of hypothesis, Research Designs.
Unit2	Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire, Sampling fundamentals and sample designs, Measurement and Scaling Techniques
Unit3	Data Processing: Significance in Research, Stages in Data Processing: Editing, Coding, Classification, Graphic Presentation (using MS Office) Statistical Analysis, Testing of Hypotheses Interpretation of data: significance and Precautions in data interpretation.
Unit4	Modem Practices: Ethical Norms in Research, Plagiarism, Role of Computer Softwares and internet in Research.
Unit5	Research Reporting and Modern Practices in Research, Research Report Writing: Importance, Essentials, Structure/layout, Types, References and Citation Methods: APA (American Psychological Association) CMS (Chicago Manual Style) MLA (Modern Language Association) Footnotes and Bibliography

SuggestedReadings:

1. Research Methodology, by Deepak Chawla/ Neena Sondhi (Vikas)
2. BRM by Zikmund/Babin/Carr/Adhikari / Griffin (Cengage))
3. Research Methodology, by V. Upadade&A. Shende (S. Chand)
4. Business Research Methods by Naval Bajpai, Person
5. Business Research Method by Cooper et al, McGraw Hill
6. Research Methodology by Khatua and Majhi, HPH.

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Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Elective**
Paper Title:		**International Financial Management**
Paper Code:		**FE:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	**Introduction:** Globalisation and the multinational firm Complexities and issues in financial decisions of a multinational firm. Foreign investment decision: exchange rate movement and decision to invest; foreign direct investment theories and strategies Greenfield investment Vs Cross border M and As. Foreign exchange market-spot and forward market, Participants in foreign exchange market. Arbitrage, hedging and speculation, covered interest arbitrage. Contemporary issues in international financial management.
Unit2	**International Capital Budgeting Decision**: Estimation of cash flows from cross border investment projects. Valuation techniques including Adjusted Present Value method. Risks in cross border investment decision- currency risk, political risk, country risk, inflation risk, etc. Techniques for incorporating risks in cross border investment decision. Assessment and management of political risk. Country risk analysis.
Unit3	**Financing Decision, Dividend Policy and Working Capital Management in a Multinational firm**: International capital structure and cost of capital. Determinants of capital structure of MNEs. Financing of foreign subsidiaries or projects- Internal and External sources, Parent Debt and Parent Equity, Bank Guarantees etc. Dividend policy of MNEs. International working capital management-Cash management, inventory management and receivables management.
Unit4	**International Diversification and Portfolio Investment**: Risk factors in international investing. International diversification- risk and return aspects. International CAPM. Identification of optimal portfolio.
Unit5	**International Accounting and International Taxation**: Foreign currency translation; Multinational transfer pricing and performance measurement; consolidated financial statements; International accounting standards and practices. Relevant accounting standard in India (AS-11). International tax environment; bilateral tax treaties and tax heavens. Impact of taxation on cross-border investment decisions.

SuggestedReadings:

1. International Financial Management', Thummuluri Siddaiah; Pearsons
2. International Financial Management', Eun, Cheol S. and Resnick, Bruce G., Tata McGraw-Hill.
3. Multinational Financial Management', Apte P.G., Tata -McGraw Hill, New Delhi.
4. International Financial Management', Bekaert, Greet and Hodrick, Robert J., Prentice Hall.
5. International Financial Management', Madura, Jeff, Cengage Learning.
6. Multinational Financial Management', Shapiro, Alan C., John Wiley.
7. International Financial Management', Sharan, V., PHI Learning Pvt. Ltd.
8. International Finance', Levi D, Maurice, Routledge.

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Elective**
Paper Title:		**International Marketing Management**
Paper Code:		**ME:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	**Introduction to International Marketing**: Nature and significance; Complexities in international; Transition from domestic to transnational marketing, International marketing orientation - EPRG framework; International Market entry strategies **International Marketing Environment**: Internal environment; External environment; geographic, demographic economic, socio-cultural political and legal environment; impact of environment on international marketing decisions
Unit2	**Foreign Marketing Selection**: Global marketing segmentation; selection of foreign markets; International positioning **Product Decision**: Product planning for global markets; standardization vs. product adaption, new product development: Management of international brands; Packaging labeling; Provision of sales related services
Unit3	**Pricing Decision**-Environment influences on pricing decision international pricing policies and strategies. **Promotion Decision**: Complexities and issues; international advertising, personal selling, sales promotions and public relation
Unit4	**Distribution Channels and Logistic**: Functions and types of channels; Channels selection decisions; Selection of foreign distributors/agents and managing relations with them; International logistic decisions. **International Marketing, Planning, Organizing and Control**: Issues in International marketing Planning: International marketing operations.
Unit5	**Emerging Issues and Developments in International Marketing:** Ethical and Social Issues; issues; International marketing of Services; Information technology and International marketing; Impact of Globalization; WTO.

SuggestedReadings:

1. International Marketing by R. Srinivasan
2. International Marketing by Dr. R. K. Kothari &
3. International Marketing by Rajgopal & Dr. P.C. Jain
4. International Marketing by Sunil Gupta & Kulbhushan Chandel

St.Aloysius'College(Autonomous),Jabalpur(M.P.)

Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Elective**
Paper Title:		**Corporate Tax Planning**
Paper Code:		**TE:05**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Concept of Tax Planning: Meaning, Scope, Importance, Objectives of Tax Planning, Tax Avoidance, Tax Evasion, and Tax Planning
Unit2	Tax Management: Introduction, Difference between Tax Planning and Tax Management, Areas of Tax Management, Problems in tax planning.
Unit3	Scope of Tax Planning: Ownership Aspect, Activity Aspects & Locational Aspects, Nature of the Business & Tax Planning
Unit4	Special Tax Provisions for New Start-ups, Free Trade Zones, Infrastructure Sector & Backward Areas. Tax Incentives for Exporters. Tax Planning and Setting up New Business: Deductions Available to New Industrial Undertakings, Amalgamation, Merger and Tax Planning
Unit5	Financial Decisions Tax Planning: Capital Structure Decision, Inter Corporate Dividend, Bonus Shares, Purchase of Assets Out of Own Funds or Out of Borrowed Funds

Suggested Readings:

1. Shripal Saklecha & Anit Saklecha-- Tax Planning and Management (Satish Printers and Publishers)
2. Dr RK Jain- Tax Planning and Management (SBPD Publication)

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Course		**M.Com**
Semester:		**IV**
Compulsory/Elective:		**Open Elective**
Paper Title:		**Human Resource Development**
Paper Code:		**OE:06**
Max Marks	**Theory**	**Internal Assessment**
50	**40**	**10**

Unit1	Introduction to Human Resource Development: Concept and evolution, Relationship between human resource management and human resource development; HRD mechanisms, processes and outcomes, HRD Matrix; HRD interventions, Roles and competencies of HRD professionals.
Unit2	HRD Process: Assessing HRD needs, Designing and developing effective HRD programs; Implementing HRD programs; Evaluating HRD programs.
Unit3	Learning and HRD: Maximizing learning: Individual differences in the learning process, Learning strategies and styles, Principles of learning, Learning and motivation, HRD culture and climate,
Unit4	HRD Activities and Applications: HRD for Workers; HRD mechanisms for workers, Role of trade unions; Employee training and development-Process, methods, and types; Coaching, counseling and performance management, Career management and development; Organization development.
Unit5	HRD in Organisations, Trends and Practices: Select cases for HRD Practices in Government organisations, defence, police, private sectors and public sectors units; HRD audit; Balanced scorecard; People capability maturity model; Integrating HRD with technology, Employer branding and other recent trends; Future of HRD.

Suggested Readings:

1. J. M., DeSimone, RL, Human resource development, South Western.
2. Nadler, L., Corporate human resources development, Van Nostrand Reinhold.
3. Blanchard, P.N., Thacker, J. W., Anand Ram, V., Effective training, systems, strategies, and practices,Pearson Education.
4. Raymond, N. and Kodwani, A.D., Employee training and development, McGraw Hill Education India.
5. Mankin, D., Human resource development, Oxford University Press India.
6. Haldar, U. K., Human resource development, Oxford University Press India.
7. Rao, TV, Future of HRD, Macmillan Publishers India.
8. Rao, T.V., HRD score card 2500: Based on HRD audit, Response Book, SAGE Publication

SYLLABUS

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ECONOMICS

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 Economics

Syllabus

M.A. I to IV Semester

2023-24

M.A. Ist Semester

Paper - I: Micro Economic Analysis-I

Max. Marks: 40

Unit -1

Introduction- Micro Economics: Meaning, Scope, Significance and Limitations, Basic Economic Problems- Scarcity and Choice, Relationship between Micro and Macro Economic Analysis, Methods of Economic Analysis: Deductive and Inductive; Economic Statics and Dynamics, Positive and Normative Economics, Partial and General Equilibrium Analysis

Unit-2

Demand Analysis:- Theory of Utility and Consumer Behavior- Indifference Curve Analysis- Definition and Properties, Consumer's Equilibrium Price, Income and Substitution Effect: Hicks and Slutsky , Engel Curve, Derivation of Demand Curve

Unit-3

Demand Analysis:- Strong and Weak Ordering Hypothesis, Samuelson's Theory of Revealed Preference, Hicks Revision of Demand Theory, Elasticity of Demand and its Types, Consumer's Surplus, Marshallian and Hicksian Measure of Consumer Surplus

Unit-4

Supply Analysis: Theory of Production- Production Function, Short and Long run Production Function, Cobb- Douglas Production Function, Law of Variable Proportions and Returns to Scale, Isoquants, Optimum Factor Combination- Producer's Equilibrium, Expansion Path and Ridge Lines.

Unit -5

Welfare Economics: Meaning and Nature, Role of Value Judgment, Pigovian Welfare Economics, Dual Criteria, Pareto's Welfare Economics, Marginal Condition for Pareto's Optimum and Unanimity Rule, Social Welfare Function Compensation Principle. Arrow's Impossibility Theorem.

Recommended Books:

- Kreps David M. (1990), A Course in Microeconomic Theory, Princeton University press. Princeton.
- Koutsoyiannis, A.(1979), Modern Microeconomic (2nd Edition), Macmillan press, London.
- Layard, P.R.G. and A.W. Walters (1978), Microeconomic Theory, McGraw Hill, New York.
- Sen, A. (1999), Microeconomic Theory and Application, Oxford University press, New Delhi.
- Baumol, W.J. (1982) Economic Theory and Operations Analysis, Prentice Hall of India, New Delhi.
- Hirshleifer, J. and A. Glazer (1997), Price Theory and Application, Prentice Hall of India, New Delhi.
- Green, H.A.G. (1971), Consumer Theory, Penguin, Harmondsworth.
- Henderson. J.M. and R.E. Quandt (1980) Microeconomic Theory : A Mathematical Approach, McGraw Hill, New Delhi.
- Da Costa, G.C. (1980), Production, Prices and Distribution, Tata McGraw Hill New Delhi.
- Arrow, K.J. and M.D. Intrilligator (Eds.) (1981), Handbook of Mathematical Economics, Volleyball. 1, North Holland, Amsterdam.
- Varian.H.R.- "Micro Economics A modern Approach".
- McConenell& Brue.- " Micro Economics Principal, problems & policies". Mc.Grow Hills.
- Ahuja, H.L. .- " Advanced Economic theory"
- Jain K.P.- " Advanced Economic theory"
- Jhingan M.L.- " Modern Micro Economics"

Paper - II Macro Economic Analysis

Max. Marks: 40

Unit -1

Nature of Macro Economics, Basic Concepts, Stock and Flow Variables, National income and its Measurements, GDP and GNP, Importance of National Income Estimation, National Income and Economic Welfare, National Income Estimation in India.

Unit – 2

Income Determination in Closed and Open Economy, Consumption Function, APC-MPC, Factors affecting Consumption Function, Concept of Multiplier and Accelerator.

Unit - 3

Money Supply, Determination of Money Supply, Interest Rate and Theory of Liquidity Preference, IS-LM Analysis, Monetary Policy and its Instruments. **Monetary Policy Committee.**

Unit - 4

Theories of Employment- Classical theory, Say's Law of Market, Keynesian Theory of Employment, Keynes Vs. Classical, Measurement and Trends of unemployment in Indian Economy.

Unit- 5

Theories of Investment: Determinants of Investments, MEC and MEL, Saving Function, Paradox of Thrift, Investment Multiplier, Consumption, Saving and Investment measurement in Indian Economy.

Recommended Books:

- Ackley,G.(1978), Macro Economics : Theory and Policy, Macmillan, New York.
- Blackhouse, R. and A. Salansi (Eds.) (2000) Macroeconomics and the Real World (2 Vols.), Oxford University Press, London.
- Dornbusch, R. and F. Stanley (1997), Macroeconomics, McGraw Hill, Inc, New York.
- Jha, R. (1991), Contemporary Macroeconomic Theory and Policy, Wiley Eastern Ltd., New Delhi.
- Shapiro, E.(1996) Macroeconomic Analysis, Galgotia Publications, New Delhi.
- Edey, M. and A.T. Peacock (1967), National Income and Social Accounts, Hutchinson University Library London.
- Rao, V.K.R.V. (1983) India's National Income : 1950 to 1980, Saqe Publications, New Delhi.
- Ruggles, R. and N. Ruggles (1956), National Income Accounts and Income Analysis, McGraw Hill New York.
- Duesenberry, J.S. (1949), Income Saving and the Theory of Consumer Behaviour. Harvard University Press, Harvard.
- Friedman, M. (1957), The Theory of Consumption Function, Princeton University Press Princeton.
- Keynes, J.M.(1936), The General Theory of Employment Interest and Money, Macmillan, London.
- Culbertson, J.M. (1968), Macroeconomic Theory and Stabilization Policy, McGraw Hill, Kogenkosh, Tokyo.
- Gupta, S.B. (1995), Monetary Planning in India, Oxford University Press, New Delhi.

- Friedman, M. (1956), Studies in the Quantity Theory of Money, The University of Chicago Press, Chicago.
- E.J. Shapiro ,Macro Economic Analysis
- W.H.Bransin ,Macro Economic Theory and Policy
- M.L.Jhingan , "Macro Economic Theory"
- M.C.Vaishya , Macro Economic Theory
- M.L. Seth Macro Economics

Paper – III Quantitative Techniques

Max. Marks: 40

Unit-1

Measures of Central Tendency- Mean Median and Mode, Dispersion. Interquartile Deviation, Quartile Deviation, Mean Deviation, Standard Deviation, Skewness and Kurtosis.

Unit -2

Simple Differentiation and Integration and its Application in Economics i.e., Calculation of Elasticity Coefficient, Cost, Revenue and Productivity, Graphical and Diagrammatic Presentation.

Unit - 3

Linear and Simultaneous Equations up to Three Variables and its Application in Economics, Calculation of Equilibrium Prices, Impact of Tax and Subsidy on Demand and Supply, Calculations of Factor Prices, Calculations of Macro Economic Variables. ***Application of Minima and Maxima in Economics.***

Unit - 4

Correlation Analysis: Karl Pearson Correlation, Spearman's Rank Correlation. Regression Analysis: Concept, Regression lines, finding Regression Coefficients and Equations, Interpolation and Extrapolation; Concept, Significance, Assumptions, Methods of Interpolation and Extrapolation.

Unit -5

Index Numbers: A Conceptual frame work, Uses, Types, Problems in Construction of Index Numbers, The Chain Index Numbers, Base Shifting and Deflating the Index Numbers, Cost of Living Index Numbers, Fishers' Index Number.

Recommended Books:

- Allen, R.G.D.(1974), Mathematical Analysis for Economists, Macmillan Press and ElBS, London.
- Chiang, A.C.(1986), Fundamental Methods of Mathematical Economics, McGraw Hill, New York.
- Gupta, S.C.(1993), Fundamental of Applied Statistics, S. Chand & Sons, New Delhi.
- Speigal, M.R.(1992), Theory and Problems of Statistics, McGraw Hill Book Co., London.
- Yamane, Taro (1975), Mathematical for Economists, Prentice Hall of India, New Delhi.
- Baumol, W.J.(1984), Economic Theory and Operations Analysis, Prentice Hall, Englewood Cliffs, New Jersey.
- Monga, G.S.(1972), Mathematical and Statistics for Economists, Vikas Publishing House, New Delhi.
- Chou, Y. (1975), Statistical Analysis, Holt, Reinhart and Winston, New York.
- Croxton, Crowden and Klein (1971), Applied General Statistics, Prentice Hall of India, New Delhi.
- Millar, J. (1996), Statistics for Advanced Level, Cambridge University Press, Cambridge.
- Nagar, A.L. and R.K. Das (1993), Basic Statistics, Oxford University Press, New Delhi.
- Goon; A.M., M.K. Gupta and B. Dasgupta (1993), Fundamentals of Statistics, Vol. 1, The World Press Ltd., Calcutta.
- Hogg, R.V. and A.T. Craig (1970), Introduction to Mathematical Statistics (3rd Edition). Macmillan Publishing Co., New York.
- Gupta & Gupta – Statistics
- R. G.D.Allen - Statistics for Economics
- MethaandMadnani - Mathematics for Economists.
- A.L. Bowliy - Elements of Statistics
- Croxton& Cowden - Applied General Statistics
- JITSChandan - . Statistics for Business & Economics
- S.RGupta - Statistical Method
- Shukla&Sahay–Statistical Methods

Paper – IV Economic of Growth and Development

Max. Marks: 40

Unit-1

Concepts of Economic Growth and Development – Determinants of Economic Growth, Indices of Development- Human Development Index, Cost of Development, Real Cost of Development, Physical Quality of Life Index (PQLI), Concepts of Inclusive Growth and Sustainable Development.

Unit-2

Classical Theory of development - contributions of Adam Smith, Ricardo, Malthus and James Mill, Kari Marx, Schumpeter Model and Harrod - Dommar Model, Neo-classical growth models - Solow and Meade, Joan Robinsons' Model of Growth.

Unit-3

Theory of Balanced Growth –Nurkse, Lewis Growth Model with Unlimited Supply of Labour, Theory of Unbalanced Growth- Hirschman, Leibenstien's Model of Growth.

Unit-4

Rostows' Stages of Growth, Big Push Theory, Mahalanobis Model, Ranis- Fei Model, Kaldor's Model of Growth.

Unit-5

Problem of Capital Formation for Economic Development, Investment Allocation, Cost Benefit Analysis, Choice of Techniques- Labour v/s Capital Intensive Techniques, Appropriate and Intermediate Technology.

Recommended Books:

1. Adelman, I. (1961), Theories of Economic Growth and Development, Stanford University Press, Stanford.
2. Chenery, H.and T.N. Srinivasan (Eds.) (1989), Handbook of Development Economics, Vols. 1&2, Elsevier, Amsterdam.
3. Kindleberger, C.P. (1977), Economic Development, (3rd Edition), McGraw Hill, New York.

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Syllabus

M.A. II Semester

M.A. II Semester

Paper - I Micro Economic Analysis-II

Max. Marks: 40

Unit 1

Cost Analysis- Short run and Long run, Cost Function and Curves: Prime and Supplementary Cost, Incremental and Marginal Cost, Total Average and Marginal Cost Curves.

Revenue Analysis- Total Average and Marginal Revenue Curves under Different Markets.

Unit – 2

Market Equilibrium: Perfect Competition- Price and Output Determination, Short and Long Run Equilibrium of the Firm and Industry, Monopoly- Short and Long Run Equilibrium Discriminating Monopoly- Definition and Equilibrium under Discriminating Monopoly.

Unit – 3

Market Equilibrium: Monopolistic Competition- Characteristics, Chamberlain's Approach, Equilibrium of the Firm and Group with Product Differentiation and Selling Cost, Theory of Excess Capacity, Oligopoly: Collusive and Non Collusive Model, Kinked Demand Curve and Price Rigidity, Market Sharing Cartels and Price Leadership.

Unit – 4

Theories of Distribution: Marginal Productivity Theory, Rent- Meaning and Nature, Ricardian and Modern Theory, Comparison between Ricardian and Modern Theory. Wage- Meaning and Nature, Wage Determination under Competitive and Non - Competitive Condition.

Unit – 5

Theories of Distribution: Interest- Meaning and Nature, Classical Theory, Keynesian Theory and Hicks- Hanson Synthesis**; Profit-** Meaning and Nature, Knight's Theory and Schumpeterian Theory of Profit.

Recommended Books:

- Kreps David M. (1990), A Course in Microeconomic Theory, Princeton University press. Princeton.
- Koutsoyiannis, A.(1979), Modern Microeconomic (2nd Edition), Macmillan press, London.
- Layard, P.R.G. and A.W. Walters (1978), Microeconomic Theory, McGraw Hill, New York.
- Sen, A. (1999), Microeconomic Theory and Application, Oxford University press, New Delhi.
- Baumol, W.J. (1982) Economic Theory and Operations Analysis, Prentice Hall of India, New Delhi.
- Hirshleifer, J. and A. Glazer (1997), Price Theory and Application, Prentice Hall of India, New Delhi.
- Green, H.A.G. (1971), Consumer Theory, Penguin, Harmondsworth.
- Henderson. J.M. and R.E. Quandt (1980) Microeconomic Theory : A Mathematical Approach, McGraw Hill, New Delhi.
- Da Costa, G.C. (1980), Production, Prices and Distribution, Tata McGraw Hill New Delhi.
- Arrow, K.J. and M.D. Intrilligator (Eds.) (1981), Handbook of Mathematical Economics, Volleyball. 1, North Holland, Amsterdam.
- Kreps. David M. (1990), A Course in Microeconomic Theory Princeton UniversityPress, Princeton,
- Ahuja, H.L.- " Advanced Economic Theory"
- Jain K.P.- " Advanced Economic theory"
- Jhingan M.L.- " Modern Micro Economics"

Paper - II Monetary Economics and Banking

Max. Marks: 40

UNIT 1

Money: Meaning and functions, Measures of Money Stock, Liquidity Approach to Quantity of Money, Credit Creation, Methods of Note Issue in India**,** Monetary Policy.

UNIT 2

Meaning and Determinants of Value of Money, Theories of Value of Money- Fisher and Cambridge Approach, Keynes Theory of Money and Price, Milton Friedman's Theory, Theory of Real Balance Effect.

UNIT 3

Meaning and Types of Inflation, Deflation, Reflation and Disinflation, Measurement of Inflation, Inflation and Indian Economy, Method to Check Inflation, Relationship between Inflation and Unemployment, Philips Curve.

UNIT **4**

Banking System in India- Types of Bank, Function of Commercial Banks, New Trends in Commercial Banking, Reserve Bank of India.

UNIT-5

Business Cycle- Meaning and Nature, Phases of Trade Cycles, Theories of Trade Cycle- Non Monetary Theories, Monetary Theories- Schumpeter, Samuelson and Hicks, Measures to Control Evil Effects of Business Cycle.

Recommended Books

- Culbertson, J.M. (1968), Macroeconomic Theory and Stabilization Policy, McGraw Hill, Kogenkosh, Tokyo.
- Gupta, S.B. (1995), Monetary Planning in India, Oxford University Press, New Delhi.
- Reddy, Y.V. (2000), A Review of Monetary and Financial Sector Reforms in India - A Central Banker's Perspective, UBSPD, New Delhi.

Paper - III Statistical Inferences and Research Methodology

Max. Marks: 40

UNIT 1

Meaning and Concept of Research, Type of Research, Steps in Scientific Research, Research Design, Sampling Techniques and Techniques of Data Collection.

UNIT 2

Analysis of Time Series - Introduction, Utility and Components of Time Series, Measurement of Trend by Graphic Method, Semi Average and Moving Average Method and Least Square Method.

UNIT 3

Probability and its Theorem, Concept and Definition of Probability, Calculation of Probability, Addition Theorem and Multiplication Theorem, Theoretical Probability, Distribution- Normal, Binomial and Poisson Distribution.

UNIT 4

Hypothesis: Meaning, Types and Utility, Testing of Hypothesis, Standard Error and Sampling Distribution, Estimation, Significance of Attributes. Large Samples and Small Sample t, F, zTest and Chi-Square.

Unit 5

Research Report: Types of Reports, Characteristics of Research Report, Formulation Utility and Limitation, Footnote, References and Bibliography.

Recommended Books:

1. Gupta & Gupta - Statistics
2. D.N.EIhance - Fundamentals of Statistics (Hindi and English Edition)
3. Couner - Statistics in Theory & Practice4. R.G.D.Allen - Statistics for Economic

Paper – IV International Economics

Max. Marks: 40

Unit - 1

Distinguishing Features of Inter-regional and International Trade, Importance and Scope of International Trade, International Division of Labour and Specialization, Adam Smith's Theory of Absolute Advantage, Ricardian Theory of Comparative Cost and its Application in Underdeveloped Countries.

Unit – 2

Mill's Theory of Reciprocal Demand, Concept of Offer Curve, Explanation of Mill's Concept of Reciprocal Demand with the help of Marshall's Offer Curve, Free Trade v/s Protection, International Trade Equilibrium.

Unit – 3

Haberler's Theory of Opportunity Cost, International Trade under Constant, Increasing and Decreasing Opportunity Cost, The Modern Theory of Factor Endowment, its Explanation under Price Criterion and Physical Criterion, Its Superiority over The Classical Theory, Leontief Paradox

Unit – 4

International Trade and Factor Price, Samuelson Factor Price Equalization Theorem, The Terms of Trade- Meaning and Various Concept of Terms of Trade, Factor Affecting Terms of Trade, Terms of Trade and Underdeveloped countries.

Unit – 5

Tariffs: Meaning and Types, Optimum Tariff and Welfare Effect of Tariff on Income Distribution, The Stolper and Samuelson Theorem, Dumping, Types, Objective and Effect of Dumping, Current Incidence of Dumping in India, Its impact on our Economy, Anti-Dumping Measures.

Recommended Books:

- Bhagwati,J.(Ed.)(1981),InternationalTrade,SelectedReadings,Cambridge,UniversityPress ,Massachusetts.
- Carbough,R.J.(1999),InternationalEconomics,InternationalThompsonPublishing,NewYork.
- Chacholiades,M.(1990),InternationalTrade:TheoryandPolicy,McGrawHill,Kogakusha,Japan.
- Dana,M.S.(2000),InternationalEconomics:Study,GuideandWorkBook,(5thEdition),RoutledgeP ublishers,London.
- Dunn,R.M.andJ.H.Mutti(2000),InternationalEconomics,Routledge,London.

Kenen,P.B.(1994),TheInternationalEconomy,Cambridge,UniversityPress,London.

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Syllabus

M.A. III Semester

M.A. III Semester

Paper - I Public Economics

Max. Marks: 40

Unit-1

Nature and Scope of Public Economics, Role of Government in Organized Society, Concepts of Public Goods, Private Goods and Merit Goods, Theory of Maximum Social Advantage- Dalton, Pigou and Musgrave.

Unit - 2

Public Expenditure: Wagner's Law of Increasing State Activities, Wiseman - Peacock Hypothesis**,** Principles of Public Expenditure, Effects of Public Expenditure on Distribution, Employment, Economic Stability & Economic Development, Structure and Growth of Public Expenditure in India.

Unit- 3

Public Revenue: Sources of Public Revenue – Tax and Non Tax Revenue, Theories of Incidence of Taxation- Ability to Pay Theory, Benefit theory and Cost Service Theory, Effects of Taxation on Distribution, Effect on Employment, Effect on Economic Stability, Taxable Capacity, GST in India.

Unit- 4

Public Debt- Meaning and Sources, Burden of Public Debt, Debt Redemption, and Effects of Public Debt, Public Debt and Inflation, Debt Burden, Debt Management, Public Debt in India.

Unit- 5

Fiscal Federalism in India, Latest Finance Commission, Budget; Meaning and Preparation, Fiscal Policy and its Objectives, Fiscal Deficit and Deficit Financing in India, Concepts of Financial Inclusion.

Recommended Books:

- Atkinson, A.B. and J.E. Siglitz (1980), Lectures on Public Economics, Tata McGraw Hill, New York.
- Auerbach, A.J. and M. Feldstern (Eds.) (1985), Handbook of Public Economics, Vol. 1. North Holland, Amsterdam.
- Buchanan, J.M. (1970), The Public Finances, Richard D. Irwin, Homewood.

- Houghton, J.M. (1970), The Public Finance : Selected Readings, Penguin, Harmondsworth.
- Jha, R. (1998), Modern Public Economics, Routledge, London.
- Menutt, P. (1996), The Economics of Public Choice, Edward Elgar, U.K.
- Musgrave, R.A. (1959), The Theory of Public Finance, McGraw Hill, Kogakhusa, Tokyo.
- Herber, B.P. (1967), Modern Public Finance, Richard D. Irwin, Homewood.
- Peacock, A. and G.K. Shaw (1976), The Economic Theory of Fiscal Policy, George Allen and Unwin, London.
- Mueller, D.C. (1979), Public Choice, Cambridge University Press, Cambridge.
- Friedman, A. (1986), Welfare Economics and Social Choice Theory, Martins Nijhoff, Boston.
- Peacock, A. and D.J. Robertson (Eds.) (1963), Public Expenditure : Appraisal and Control, Oliver and Boyd, Edinburgh.
- Mundle, S. (1999), Public Finance Policy : Issues for India, Oxford University Press, New Delhi.
- R.A.Musgrave - Theory of Public Finance
- V.C. Sinha – Public Economics

Paper - II Industrial Economics

Max. Marks: 40

Unit I

Industrialization – Meaning And Importance, Process of Industrialization, Problem of Industrialization, Classification of Industries, - Size based, Use based, Input based, Proprietary based, Dangers of Heavy Industrialization.

Unit II

Industrial Combination – Definition, Advantages and Disadvantages, Forms and Types of Industrial Combinations, Localization of Industries – Concept and Significance, Theories of Industries Localization – Weber and Sargent Florence theory.

Unit III

Role of Government in Industrial Development, Licensing Policy, Industrial Policy – 1948 Policy, 1956 Policy and New Industrial Policy.

Unit IV

Industrial Productivity– Concept, Types, Measurement, Partial and Total Trends, Productivity Movement in India, Rationalization – Meaning, Objectives, Aspects, Problems, Govt. Policies towards Rationalization, Modernization in Indian Industries.

Unit V

Industrial Sickness – Definition, Extent of Industrial Sickness in Indian Industries, Causes of Sickness, Harmful Effects of Sickness, Measures to Remove Industrial Sickness, Concentration of Economic Power and Monopoly, Measurement to Check Monopoly, UTP And RTP Provisions, Competition Act.

Recommended Books:

- Ahluwalia,I.J.(1985),IndustrialGrowthinIndia,OxfordUniversityPress,NewDelhi.
- Barthwal,R.R.(1985),IndustrialEconomics,WileyEasternLtd.,NewDelhi.
- Cherunilam,F.(1994),IndustrialEconomics:IndianPerspective(3rdEdition),HimalayaPublishingHouse,Mumbai.

- Desai,B.(1999),IndustrialEconomyinIndia(3rdEdition),HimalayaPublishingHouse,Mumbai.
- Hay,D.andD.J.Morris(1979),IndustrialEconomics:TheoryandEvidence,OxfordUniversityPress,NewDelhi.
- Kuchhal,S.C.(1980),IndustrialEconomyofIndia(5thEdition),ChaitanyaPublishingHouse,Allahabad.
- Singh,A.andA.N.Sadhu(1988),IndustrialEconomics,HimalayaPublishingHouse,Mumbai.
- Bains,J.S.(1996),IndustrialOrganization,Cheltanham,U.K.
- Kelkar,V.L.andV.V.BhanojiRao(Eds.)(1996),IndiaDevelopmentPolicyImperatives,TataMcGrawHill,NewDelhi.
- Brahmananda,P.R.andV.R.Panchamukhi(Eds.)(1987),TheDevelopmentProcessoftheIndianEconomy,HimalayaPublishingHouse,Mumbai.
- Chakravarty,S.(1987),DevelopmentPlanning:TheIndianExperience,OxfordUniversityPress,NewDelhi.
- Datta,B.(1992),IndianPlanningattheCrossroads,OxfordUniversityPress,NewDelhi.
- Joshi,V.andI.M.D.Little(1999),India:MacroEconomicsandPoliticalEconomy:1964-1991,OxfordUniversityPress,NewDelhi.
- RamaMurti,R.andR.Vernan(Eds.)(1991),PrivatizationandControlofState-ownedEnterprises,TheWorldBank,Washington.
- Sandesara,J.C.(1992),IndustrialPolicyandPlanning-1947-1991:Tendencies,InterpretationsandIssues,SagePublications,IndiaPvt.Ltd.,NewDelhi.
- Sen,R.andB.Chatterjee(2001),IndianEconomy:Agendaforthe21stCentury(EssaysinhonourofProfessorP.R.Brahmananda),DeepandDeepPublicationsPvt.Ltd.,NewDelhi.
- MamoriaandMamoria(2000),DynamicsofIndustrialRelationsinIndia(15thEdition),HimalayaPublishingHouse,Mumbai.

Paper - III Agricultural Economics (Core Elective)

Max. Marks: 40

Unit I

Agricultural Economics – Meaning, Nature and Scope, Role of Agriculture in Indian economy, Stages of Agricultural Development, Lewis Model and Ranis-Fei contribution.

Unit II

Optimum Combination: Problems in Agricultural Inputs (Inferences to Land, Labour and Capital), Agricultural System and their Types, Co-operative v/s Private Agricultural Holdings, Land Reforms in India and M.P, **Farm Bill 2020.**

Unit III

Agricultural Indebtedness, Agricultural Finance – Source, Types and Problems, Agricultural Marketing – Types and Problems, Fluctuations in Agricultural Prices, Agricultural Price Policy, ***Bhavantar and Minimum Support Price***.

Unit IV

Agricultural Development in Planning Period, Technical Development in Agriculture, Dry Farming, Green Revolution, Farm Management, Agricultural Taxation.

Unit V

Issues of Indian Agriculture in Global Perspective, Provisions regarding Agriculture in W.T.O. Agricultural Development in Madhya Pradesh, Agriculture related problems of Madhya Pradesh and suggestions.

Recommended Books:

- Bhaduri,A.(1984),TheEconomicStructureofBackwardAgriculture,MacmillanDelhi.
- Bilgrami,S.A.R.(1996),AgriculturalEconomics,HimalayaPublishingHouse,Delhi.
- Dantwala,M.L.et.al(1991),IndianAgriculturalDevelopmentsinceIndependence,Oxord& IBH,NewDelhi.
- Gulati,A.andT.Kelly(1999),TradeLiberalisationandIndianAgriculture,OxfordUniversity Press,NewDelhi.
- Joshi,P.C.(1975),LandReformsinIndia:TrendsandProspects,AlliedPublishers,Bombay.

Rural Development (Core Elective)

Max. Marks: 40

UNIT I

Nature of Rural Economy, Concept and Feature of Rural Development, Causes of Rural Backwardness in India, Importance of Rural Development for Indian Economy, Relationship of Rural Development with Industrial Development and Service Sector.

UNIT II

Dimensions of Rural Development: Agriculture, Irrigation, Electrification and Power Supply, Rural Road, Health, Education, Banking in Rural Areas, Sanitation, Safe Drinking Water, Productivity Level

UNIT III

Institutions for Rural Development: National Bank for Agriculture and Rural Development (NABARD), Pachayati Raj Institutions, ***Co-operative Banks,*** Commercial Banks and Regional Rural Banks.

UNIT IV

Various Programme for Rural Development in India: Provision of Urban Amenities in Rural Area (PURA), Mahatma Gandhi National Rural Employment Guarantee ACT 2005 (MNREGA),Pradhan Mantri Gramin Sadak Yojana (PMGSY), Rural Housing, Swarnjayanti Gram Swarojgar Yojna (SGSY), Latest Provisions and Changes in Union Budget for Rural Development.

UNIT V

Rural Development in Madhya Pradesh: Madhya Pradesh Rural Livelihood Project, Madhya Pradesh Rural Road Development Authority, Mahatma Gandhi State Institute of Rural Development, Causes of Rural Backwardness in Madhya Pradesh, Other Initiative for Rural Development in Madhya Pradesh.

Recommended Books:

- "Rural Development: Principles, Policies and Management"- Katar Singh, SAGE publication, 2009.
- "Rural development: putting the last first". R. Chambers, Harlow: Prentice Hall, (1983)
- "Rural Development of India", V. Desai, Himalaya Publishing House, 2010

Paper – IV Environmental Economics (Open Elective)

Max. Marks: 40

Unit I

Meaning of Environmental Economics, Inter-linkages between Economics, Environment and Ecology, Environment Quality as a Public Good, National Income Accounting and Environment, Environmental Problems of Economy.

Unit II

Economics of Pollution, Impact of Water Pollution and Air Pollution on Economy, Sustainable Industrialization, ***Sustainable Development***.

Unit III

Social Cost Benefit Analysis- Methods, Applications and Limitations, Environment Impact Analysis (FIA), Environment Impact Statement (EIS), Environment Auditing (EA).

Unit IV

Global Environmental Problems – Global Warming, Acid Rains, Deforestation, Impact of Climate Change on Economy, ***Earth Summits***.

Unit V

Constitutional Rights and Duties Regarding Environment, Salient features of National Environment Policy 2006, The Environment (Protection) Act 1986.

Recommended Books:

- Baumol, W.J. and W.E. Oates (1988), The Theory of Environmental Policy, (2nd Edition), Cambridge University Press, Cambridge.
- Hanley, N., J.F. Shogern and B. White (1997), Environmental Economics in Theory and Practice, Macmillan.
- Hussen, A.M. (1999), Principles of Environmental Economics, Routledge London.
- Klostad, C.D. (1999), Environmental Economics, Oxford University Press, New Delhi.

- Pearce, D.W. and R. Turner (1991), Economics of Natural Resource Use and Environment, John Hopkins University Press, Baltimore.
- Tietenberg, T. (1994), Environmental Economics and Policy, Harper Collins, New York.
- Crones, R. and T. Sandler (1989), The Theory Externalities and Public Goods, Cambridge University Press, Cambridge.
- Mitchell, R.C. and R.T. Carson (1993), Using Surveys to Value Public Goods : Resources for the Future, Washington, D.C.
- Smith, V. Kerry (1996), Estimating Economic Values for Nature : Methods for Non-market Valuation, Edward Elgar, Cheltenham, U.K.
- Markandya, A. and M.N. Murty (2000), Cleaning up the Ganges : Cost-Benefit Analysis of Ganga Action Plan, Oxford University Press, New Delhi.
- Hoel, M. (1997), International Coordination of Environmental Policies in New Dimensions in the Economic Theory of Environment, Carrao Carlo and DomenicoSiniscalco (Eds.), Cambridge University Press, Cambridge.
- Mehata, S., S. Mundle and U. Sankar (1995), Controlling Pollution : Incentives and Regulation, SAGE, New Delhi.
- Dasgupta, P.S. and G.M. Heal (1985), Economic Theory and Exhaustible Resources, Cambridge University Press, Cambridge Mass.
- Markandya, A. and J. Richardson (Eds.), The Earth Scan Reader in Environmental Economics, Earth Scan, London.
- Bhattacharya, R.N. (Ed.) (2001), Environmental Economics : An Indian Perspective, Oxford University Press, New Delhi.
- Chopra, K. and S.C. Gulati (2000), Migration and the Management of Common Property Resources : A Study in Western India, Sage, New Delhi.

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Syllabus

M.A. IV Semester

Paper - I Indian Economy: Structure, Problems and Policy

Max. Marks: 40

UNIT I

Basic Economic Indicators, Sectors of Indian Economy- Primary, Secondary and Tertiary, Demographic Trends and Population Policy, National Income.

UNIT II

Agriculture- Cropping Pattern, Productivity, Mechanization and Green Revolution, Agriculture Pricing, Problem of Indian Agriculture.

UNIT III

Economic Development- Definition, Indicator of Economic Development, Five Year Planning in India- Strategy, Failures and Achievements of Economics Planning in Indian, 12th Five Year Plan, ***NITI Aayog – Constitution, Functions and Role in Indian Economy.***

UNIT IV

Industrial policy; Public Sector Enterprises and their Performance; Problem of Sick Units in India; Privatisation and Disinvestment Debate; Growth and Pattern of Industrialization; Small-scale Sector; Productivity in Industrial Sector; Exit Policy - Issues in Labour Market Reforms; Approaches for Employment Generation

UNIT V

Trends in Revenue and Expenditure of Central Government in India, Analysis of Latest Union Budget, Problem of Rising Prices, Poverty and Unemployment.

Recommended Books:

- Ahluwalia,I.J.andI.M.D.Little(Eds.)(1999),India's EconomicReformsandDevelopment(EssayinhonourofManmohanSing),OxfordUniversityPress,NewDelhi.
- Bardhan,P.K.(9thEdition)(1999),ThePoliticalEconomyofDevelopmentinIndia,OxfordUniversityPress,NewDelhi.
- Bawa,R.S.andP.S.Raikhy(Ed.)(1997),StructuralChangesinIndianEconomy,GuruNanakDeveUniversityPress,Amritsar.
- Brahmananda,P.R.andV.R.Panchmukhi(Eds.)(2001),DevelopmentExperienceintheIndianEconomy:Inter-StatePerspectives,Bookwell,Delhi.

Paper - II Indian Foreign Trade and International Institutions

Max. Marks: 40

Unit I

Foreign Trade and Economic Development, Meaning and Components of Balance of Payments, Equilibrium and Disequilibrium of Balance of Payment, Factors Causing Disequilibrium in Balance of Payment, Technical Progress and International Trade.

UNIT II

Adjustment Mechanism of Balance of Payment under Gold Standards, under Flexible Exchange Rate (Price Effect), Under Elasticity approach, Marshall Lerner Condition under Capital Movement and Direct Control for Adjustment, Foreign Trade Multiplier and Determination of Income.

UNIT III

Concept of Foreign Exchange Rate: Determination of Equilibrium Exchange Rate, Theories of Exchange Rate Determination- The Purchasing Power Parity Theory and The Balance of Payment Theory, Factor Causing Changes in Exchange Rate, Relative Merits and Demerits of Fixed and Flexible Rate, Convertibility of Currency.

UNIT IV

Exchange Control: Meaning, Features, Objectives and Methods of Exchange Control, Devaluation- Devaluation of Indian Rupee and its Impact on Our Economy, Free Trade vs. Protection, Cases for and against.

UNIT V

World Trade Organization: Functions, Structure, Objectives and Working of WTO, India and WTO, Trade Blocks: EU, NAFTA, ASEAN; International Monetary Fund (IMF) Origin, Objectives and Functions, India & IMF, World Bank, Trade and BOP in India; Major Problem of Indian Export Sector.

Recommended Books:

- Bhole, L.M. (1999), Financial Institutions and Markets, Tata McGraw Hill Company Ltd., New Delhi.
- Bhole, L.M. (2000), Indian Financial System, Chugh Publications, Allahabad.
- Edminster, R.O. (1986), Financial Institutions, Markets and Management, McGraw Hill, New York.
- Hanson, J.A. and S. kathuria (Eds.) (1999),India : A Financial Sector for the Twenty-first Century, Oxford University Press, New Delhi.
- Johnson, H.J. (1993), Financial Institutions and Markets, McGraw Hill, New York.
- Bishop, P. and D. Dixon (1992), Foreign Exchange Handbook, McGraw Hill, New York.
- Machiraju, H.R. (1997), International Financial Markets in India, Wheeler Publishing, Allahabad.
- Bhagwati,J.(Ed.)(1981),InternationalTrade,SelectedReadings,Cambridge,UniversityPress,Massachusetts.
- Carbough,R.J.(1999),InternationalEconomics,InternationalThompsonPublishing,NewYork.
- Chacholiades,M.(1990),InternationalTrade:TheoryandPolicy,McGrawHill,Kogakusha,Japan.
- Dana,M.S.(2000),InternationalEconomics:Study,GuideandWorkBook,(5thEdition),RoutledgePublishers,London.
- Dunn,R.M.andJ.H.Mutti(2000),InternationalEconomics,Routledge,London.
- Kenen,P.B.(1994),TheInternationalEconomy,Cambridge,UniversityPress,London.

Paper - III Financial Institutions and Markets (Core Elective)

Max. Marks: 40

UNIT I

Introduction to Financial Market-Evolution of the Financial Market, Segment of Financial Market, Types of Financial Products, Stages in the Development of Financial Products,Role of Financial Markets.

UNIT II

Money Market- Definition of Money Market, Characteristics and Function, Money Market Instruments and Factors Affecting its Growth, Development of Money Market in India, Role of RBI in the Development of Money Market.

UNIT III

Capital Market -Definition of Capital Market, Characteristics and Functions, Capital Market Instruments, Primary and Secondary Market, Role of SEBI in Regulation of the Capital Market, Reforms in the Capital Market.

UNIT IV

Non-Banking Finance Companies- Meaning and Features of Non- Banking Finance Companies, Types of Non-Banking Finance Companies, Services Provide by NBFCs, Regulation of NBFC companies Growth of NBFC in India.

UNIT V

Technology and Financial Market- Technological Developments in Financial Market, Impact of Technology on the Financial Market, Online Trading Clearing and Settlement System, Technology and Payment System, Role of E- Commerce in the Development of Financial Market, Introduction and Structure of Foreign Exchange Market.

Recommended Books:

- Bhole, L.M. (1999), Financial Institutions and Markets, Tata McGraw Hill Company Ltd., New Delhi.

- Bhole, L.M. (2000), Indian Financial System, Chugh Publications, Allahabad.
- Edminster, R.O. (1986), Financial Institutions, Markets and Management, McGraw Hill, New York.
- Goldsmith, R.W. (1969), Financial Structure and Development, Yale, London.
- Hanson, J.A. and S. kathuria (Eds.) (1999),India : A Financial Sector for the Twenty-first Century, Oxford University Press, New Delhi.
- Johnson, H.J. (1993), Financial Institutions and Markets, McGraw Hill, New York.
- Khan, M.Y. (1996), Indian Financial System, Tata McGraw Hill, New Delhi.
- Machiraju, M.R. (1999), Indian Financial Systems, Vikas Publishing House, New Delhi.
- Prasad, K.N. (2001), Development of India's Financial System, Sarup& Sons, New Delhi.
- Bishop, P. and D. Dixon (1992), Foreign Exchange Handbook, McGraw Hill, New York.
- Chandra, P. (1997), Financial Markets, (4th Edition), Tata McGraw Hill, New Delhi.
- Farrell, J.L. (1997), Portfolio Management, (2nd Edition), McGraw Hill, New York.
- Machiraju, H.R. (1997), International Financial Markets in India, Wheeler Publishing, Allahabad.
- Rangaranjan, C. (1999), Indian Economics : Essays on Money and Finance, UBS Publication, New Delhi.
- Verma, J.S. (1989), A manual of Merchant Banking, Bharat Law House, New Delhi.

Paper – III Labour Economics (Core Elective)

Max. Marks: 40

UNIT I

Nature and characteristics of labour markets in developing countries like India; Paradigms of labour market analysis - Classical, neo-classical and dualistic economy; Demand for labour in relation to size and pattern of investment.

UNIT II

Choice of technologies and labour policies; Supply of labour in relation to growth of labour force; Labour market policies; Mobility and productivity of labour; Rationalization; Methods of recruitment and placement; Employment service organization in India.

UNIT III

Employment and development relationship - Poverty and unemployment in developing countries; Unemployment - Concept, Types, and Measurement, particularly in India, **Migrant Labour in India.**

UNIT IV

Impact of rationalization, technological change and modernization on employment in organized private industry, Public sector and employment in agricultural sector; Analysis of educated unemployment; Employment policy in Five Year Plans and its evaluation.

UNIT V

Classical, neo-classical and bargaining theories of wage determination; Concepts of minimum wage, living wage and fair wage in theory and practice; Discrimination in labour markets; Wage determination in various sectors - rural, urban, organized, unorganized and in informal sectors; Non-wage component of labour remuneration;

Recommended Books:

- Datt,G. (1996), Bargaining Power, Wages and Employment : An Analysis of Agricultural Labour Markets in India, Sage Publications, New Delhi.
- Hajela, P.D. (1998), Labour Restructuring in India : A Critique of the New Economic Policies, Commonwealth Publishers, New Delhi.
- Jhabvata, R. and R.K. Subrahmanya (Eds.) (2000), The UnorganisedSector : Work Security and Social Protection, Sage Publications, New Delhi.
- McConnell, C.R. and S.L. Brue (1986), Contemporary Labour Economics, McGraw-Hill, New York.
- Papola, T.S., P.P. Ghosh and A.N. Sharma (Eds.) (1993), Labour, Employment and Industrial Relations in India, B.R. Publishing Corporation, New Delhi.
- Rosenberg M.R. (1988), Labour Markets in Low Income Countries in Chenery, H.B. and T.N. Srinivasan, (Eds.) The Handbook of Development Economics, North-Holland, New York.
- VenkataRatnam, C.S. (2001), Globalization and Labour-Management Relations : Dynamics of Change, Sage Publications/Response Books, New Delhi.
- Papola, T.S. and Rodgers, G. (Eds.) (1992), Labour Institutions and Economic Development in India, International Institute for Labour Studies, Geneva.
- Solow, R.M. (1990), Labour Market as an Institution, Blackwell, London.
- Deshpandey, L.K., P.R.Brahmananda, E.A.G. Robinson, (Eds.) (1983) Employment Policy in a Developing Economy, Vol. I & II Macmillan, London.
- Papola, T.S. and Sharma, A.N. (Eds.) (1999), Gender and Employment in India, Vikas Publishing House, New Delhi.
- Sharma, A.N.and A. Kundu (Ed.) (2001), Informal Sector in India : Emerging Perspectives, Institute for Human Development, New Delhi.

Paper – IV Economics of Gender and Development (Open Elective)

Max. Marks: 40

UNIT I

Importance and concepts of women studies, Demography of female population: Age structure, mortality rates, and sex ratio - Causes of declining sex ratios and fertility rates in developing countries particularly in India.

UNIT II

Women and their access to nutrition, health, education, and social and community resources, and their impact on female mortality and fertility, ***economic status and female work participation rate in India.***

UNIT III

Factors affecting decision making by women, property rights, access to and control over economic resources, assets; Power of decision making at household, community level, women education in developing countries and India.

UNIT IV

Concept and analysis of women's work: Valuation of productive and unproductive work; visible and invisible work; paid and unpaid work; economically productive and socially productive work - Economic status, private property, and participation of women in pre-industrial and industrial societies-Female contribution to National Income.

UNIT V

Factors affecting female entry in labour market, Studies of female work participation in agriculture, ***non-agricultural rural activities***, informal sector, cottage and small-scale industries, organized industry, and services sector, ***Wage differentials in female activities***, Determinants of wage differentials, gender, education, skill, productivity, efficiency, opportunity, Structures of wages across regions and economic sectors.

Recommended Books:

- Agnihotri, S.B. (2000), Sex ratio in Indian Population : A Fresh Exploration, Sage Publications, New Delhi.
- Agrawal, B. (1994), A Field of One's Own : Gender and Land Rights in South Asia, Cambridge University Press, Cambridge.
- Ahmed, I. (Ed.) (1985), Technology and Rural Women : Conceptual and Empirical Issues, George Allen &Unwin, London.
- Amsden, A.H. (Endavours.) (1980), The Economics of Women and Work, Penguin, Harmondsworth.
- Baud, I.S.A. (1992), Forms of Production and Women's Labour : Gender Aspects of Industrialization in India and Mexico, Sage Publications, New Delhi.
- Buvinic, M. and M.A.Lycette (1989), 'Women, Poverty and Development in the Third World;, in Lewis J.P. (Ed.) Strengthening the Poor : What Have We Learnt, OECD.
- Gupta, J.A. (2002), New Reproductive Technologies, Women's Health and Autonomy, Indo Dutch Studies on Development Alternatives, Sage Publications, New Delhi.
- Kabeer, N. and R. Subrahmanyam (Ed.) (1999), Institutions, Relations and Outcomes : A Framework and Case Studies for Gender-aware Planning, Kali for Women, New Delhi.
- Krishnaraj, M., R.M. Sudarshan and A. Sahriff (1999), Gender, Population and Development, Oxford University Press, New Delhi.
- Mies, M. (1986/1998), Patriarchy and Accumulation on a World Scale : Women in the International Division of Labour, Zed books, London.
- Mitra, A. (1979), Implications of Declining Sex Ratio in India's Population, Allied, New Delhi.
- Narasimhan, S. (1999), Empowering Women : An Alternative Strategy from Rural India, Sage Publications, New Delhi.
- Papola, T.S. and A.N.Sharma (Eds.) (1999), Gender and Employment in India, Vikas Publishing House, New Delhi.

SYLLABUS

PG

CHEMISTRY

St. Aloysius (Autonomous) College, Jabalpur
Department of Chemistry

M.Sc. (CHEMISTRY)

(FOUR SEMESTER COURSE)

Choice Based Credit system is implemented in PG Chemistry since 2018-19. Each semester has core and elective papers with 4 credits and 2 practical papers of 2 credits each.

Distribution of Credits in Each Semester

M.Sc I + II Semester

4 Core paper – 04 Credits each	4 *4 = 16 Credits
1 Elective paper – 04 Credits	1 *4 = 4 Credits
2 Practical's – 02 Credits each	2*2 = 4 Credits
Skill Development – 01 Credit	1 *1 = 1 Credits
Tutorial – 01 Credit	1 *1 = 1 Credits
Total Credits	**26 Credits**

M.Sc III Semester

3 Core paper – 04 Credits each	3 *4 = 12 Credits
2 Elective paper – 04 Credits	2 *4 = 8 Credits
2 Practical's – 02 Credits each	2*2 = 4 Credits
Skill Development – 01 Credit	1 *1 = 1 Credits
Tutorial – 01 Credit	1 *1 = 1 Credits
Total Credits	**26 Credits**

M.Sc IV Semester

2 Core paper – 04 Credits each	2 *4 = 8 Credits
2 Elective – 04Credits	2 *4 = 8 Credits
1 Minor Project/Dissertation/Internship	5 Credits
Skill Development – 01 Credit	1 *1 = 1 Credits
Total Credits	**22 Credits**
Grand Total of Credits	**100 Credits**

SEMESTER I

Course No.	**Course**	**Credit**	**Theory Marks**	**CIA Marks**
Course MCH 101	Inorganic Chemistry	4	50	50
Course MCH 102	Organic Chemistry	4	50	50
Course MCH 103	Physical Chemistry	4	50	50
Course MCH 104	Spectroscopy	4	50	50
Course MCH 105	Biology/Maths for Chemist and Computers	4	50	50
Course MCH 106	Inorganic Chemistry Practical	2	50	50
Course MCH 107	Physical Chemistry Practical	2	50	50
Total			**350**	**350**
Grand Total			**700**	

SEMESTER II

Course No.	**Course**	**Credit**	**Theory Marks**	**CIA Marks**
Course MCH 201	Inorganic Chemistry	4	50	50
Course MCH 202	Organic Chemistry	4	50	50
Course MCH 203	Physical Chemistry	4	50	50
Course MCH 204	Spectroscopy I	4	50	50
CourseMCH 205 **Elective**	**MCH 205 A** Analytical Chemistry **MCH 205 B** Photochemistry **(**Any One from **MCH 205A-B)**	4	50	50
Course MCH 206	Organic Chemistry Practical	2	50	50
Course MCH 207	Inorganic Chemistry Practical	2	50	50
Total			**350**	**350**
Grand Total			**700**	

SEMESTER III

Course No.	**Course**	**Credit**	**Theory Marks**	**CIA Marks**
Course MCH 301	Inorganic Chemistry	4	50	50
Course MCH 302	Physical Chemistry	4	50	50
Course MCH 303	**Spectroscopy II**	4	50	50
Course MCH 304 **I Elective**	**Course MCH 304 A** Medicinal Chemistry **Course MCH 304 B** Chemistry of Natural Products **Course MCH 304 C** Polymer (Any Two from **MCH304 A to C**)	4	50	50
Course MCH 304 **II Elective**		4	50	50
Course MCH 305	Organic Chemistry Practical	2	50	50
Course MCH 306	Physical Chemistry Practical	2	50	50
Total			**350**	**350**
Grand total			**700**	

SEMESTER IV

Course No.	**Course**	**Credit**	**Theory Marks**	**CIA Marks**
Course MCH 401	Inorganic Chemistry	4	50	50
Course MCH 402	Organic synthesis strategies	4	50	50
Course MCH 403 **Departmental Elective**	**Course MCH 403 A** Environmental Chemistry **Course MCH 403 B** Chemistry of materials (Any One from **MCH403A or 403 B**)	4	50	50
Course MCH 404 **Open Elective**	**Course MCH 404 A** Biochemistry **Course MCH 404B**Bioorganic Chemistry	4	50	50
Course MCH 405	Minor Project/Dissertation/Internship	5	100	
Total			**300**	**200**
Grand Total			**500**	

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. I SEM	Core	Course MCH 101	**Inorganic Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE

To develop an understanding of structure and chemical bonding present in inorganic compounds and the basic concept of *Reaction Mechanism of Transition Metal Complexes*.

UNIT I

Stereochemistry and Bonding in Main Group Compounds. VSEPR theory and its application for treating structures of inorganic molecules and ions containing lone pairs of electrons, shortcomings of VSEPR model.MO treatment of polyatomic molecules, e.g., ozone, nitrite, nitrate, hydarzoic acid and benzene.

UNIT II

Metal-Ligand Bonding .Molecular orbital theory.Qualitative aspects of metal-ligand sigma-bonding in octahedral, tetrahedral and square planar complexes.Jahn-Teller Effect *Electronic Spectra and of Transition Metal Complexes. Spectroscopic term, terms and microstates for the* p^2 *and* d^2 *configurations, Hund's rules for ground state terms, the correlation of spectroscopic terms into Mulliken symbols, electronic transition selection rules, Orgel diagrams for transition metal complexes (*d^1*-*d^9 *states). Jahn-teller effect and electronic spectra of complexes*

UNIT III

*Metal-Ligand Equilibria in Solution.*Stepwise and overall formation constants and their relationship, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by Bjerrum method , Job's and Mole ratio methods.

UNIT IV

Reaction Mechanism of Transition Metal Complexes I. Inert and labile complexes, interpretation of lability and inertness of transition metal complexes on the basis of valence bond and crystal field theories. Kinetics of octahedral substitution: acid hydrolysis, factors affecting acid hydrolysis.

UNIT V

*Reaction Mechanism of Transition Metal ComplexesII.*Base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism. Substitution reactions in square planar complexes: The *Trans* effect and the *trans* influence: Polarization and Pi-Bonding theories, applications of *Trans* effect in synthesis, Kurnakove's test of distinguishing *cis* and *trans* isomers using the concept of trans effect, mechanism of substitution reactions in square planar complexes, factors affecting substitution reactions. Acquaintance of *Trans* effect in octahedral complexes.

Course outcome:
By the end of this course student will be able to-

- Gain a thorough knowledge about VSEPR theory and its applications for treating the structure of simple inorganic and polyatomic molecules and ions.
- Build the concept of Metal Ligand Bonding and equilibria in solution state.
- Develop an understanding about electronic spectra of transition metal complexes.
- Develop the concept of reaction mechanism in transition metal complexes and factors affecting the reactions in square planar and octahedral complexes.

Suggested Reading

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.1. Carlin, Springer Verlag.
6. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. I SEM	Core	Course MCH 102	**Organic Chemistry**	Max: 40	Min: 14

Course Objective:

To develop an understanding of reactivity, structure and bonding, mechanisms, stereochemistry and aliphatic and aromatic substitution reactions of organic compounds

UNIT I

Structure and Bonding. Bonding in organic molecules. Delocalized chemical bonding-conjugation, cross conjugation, Conjugation, resonance, hyperconjugation. Aromaticity in benzenoid and non-benzenoid compounds, alternate and non-alternate hydrocarbons. Hűckel rule, anti-aromaticity, homo-aromaticity. Bonds weaker than covalent bond. Hydrogen bonding, crown ether complexes, and cyclodextrins

UNIT II

*Stereochemistry.C*hirality, elements of symmetry, molecules with more than one chiral center, threo and erythroisomers. R and S configuration. Separation of enantiomers. Regioselective, stereospecific and stereoselectiverections. Asymmetric synthesis. Optical activity in the absence of chiral carbon (atropisomerism)biphenyls, allenes and spiranes, and their nomenclature. Conformational analysis of cyclohexanes and decalins. Effect of conformation on reactivity

UNIT III

Reaction Mechanism. Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, and control, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Effect of structure on reactivity -resonance and field effects, steric effect. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.

UNIT IV

Aliphatic Nucleophilic Substitution. The S_N2, S_N1, mixed S_N2 and S_N1, and SET mechanisms. The $S_Ni$mechanism. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium. The neighbouring group mechanism, neighbouring group participation by Pi and Sigma bonds. Classical and nonclassical carbocations, norbornyl system, carbocation rearrangements

UNIT V

Aromatic Nucleophilic Substitution. The S_NAr, S_N1, benzyne and $S_{RN}1$ mechanisms. Reactivity, effect of substrate structure, leaving group and attacking nucleophile. Bucherer reaction, alkylation, and amination. The Bamberger rearrangement. The von Richter rearrangement

COURSE OUTCOME:

By the end of this course student will be able to-

- Develop concepts of the fundamentals, structure and bonding, stereochemistry and reaction mechanism in organic compounds.
- Enhance the knowledge about Aliphatic and Aromatic Nucleophilic Substitution reactions with suitable examples of some known organic chemical reactions.
- Understand the fundamentals in organic chemistry about Aromaticity, Molecular chirality, thermodynamic and kinetic control of reactions and its applications

SUGGESTED READING

1. Organic Chemistry, J. Claden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.
3. Organic Chemistry, P.Y. Bruice, Pearson Education Asia.
4. Organic Chemistry, L.G. Wade, Jr., Pearson Education.
5. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
6. Organic Chemistry, J. McMurry, Thomson Asia.
7. Organic Chemistry, T.W.G. Solomons and C.B. Fryhle, John Wiley (Asia).
8. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
9. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
10. Stereochemistry of Organic Compounds, E.L. Eliel and S.H. Wilen, John Wiley (Asia).
11. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
12. Stereochemistry of Organic Compounds, P .S. Kalsi, New Age International.
13. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman and G.S. Kriz, Thomson, Brooks/Cole.
14. Organic Spectroscopy, W. Kemp, ELBS, Macmillan.
15. Spectrometric Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C, Morrill, John Wiley
16. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
17. Spectroscopic Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hili.

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. I SEM	Core	Course MCH 103	**Physical Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

- To study the fundamentals and applications of classical and quantum mechanics
- To impart the knowledge of Chemical Dynamics to chain and enzyme catalysed reactions
- To learn the importance and utility of Chemical Thermodynamics and their role in chemistry.

UNIT I

Introduction to exact quantum mechanical results. The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to systems such as particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.

UNIT II

Approximate Methods. The variation theorem, linear variation principle. Perturbation theory (introductory idea).Application of variation method to the Helium atom.

Angular Momentum. Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum, addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

UNIT III

Classical Thermodynamics. Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties; partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity.

Derivation of phase rule and its application to three component systems, second order phase transitions.

UNIT IV

Chemical Dynamics (Part I). Methods of determining rate laws, Arrhenius equation, collision theory of reaction rates, steric factor, activated complex theory, ionic reactions, kinetic and thermodynamic control of reactions.

UNIT V

Chemical Dynamics (Part II). Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and oscillatory reactions, homogeneous catalysis, kinetics of enzyme reactions

COURSE OUTCOMES:

By the end of this course student will be able to-

- Understand quantum mechanical and classical thermodynamics principles.
- Develop an understanding of the Schrodinger equation and its applications, Perturbation theory and concept of Angular Momentum.
- Procure an in-depth knowledge about free energy, entropy and fugacity.
- Understand and apply the concepts of chemical dynamics to organic reactions and dynamic chain reactions

SUGGESTED READINGS

1. Prasad, R. K. (2014). Quantum Chemistry (IV Revised Edition). New Delhi: New Age International Publishers Pvt. Ltd.

2. Chandra, A. K. (2017). Quantum Chemistry (IV Edition). New Delhi: Tata McGraw – Hill Publishing Company Ltd.

3. House, J. E. (2004). Fundamental of Quantum Chemistry (II Edition). New Delhi: Academic Press.

4. Levine, I. N. (2016). Quantum Chemistry (VII Edition). New Delhi: Pearson Education Pvt. Ltd.

5. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2013). Principles of Physical Chemistry (46th Edition). Jalandar: Vishal Publishing Co.

6. Atkins, P., & De Paula, J. (2014). Atkins Physical Chemistry (X Edition). Oxford: Oxford University Press.

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. I SEM	Core	Course MCH 104	**Spectroscopy I**	Max: 40	Min: 14

COURSE OBJECTIVE

To understand the principle, theories, instrumentation and applications of Microwave, FT-IR, Raman and Microwave spectroscopic techniques

UNIT I

*Unifying Principles.*Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission, transmission, reflection, refraction, dispersion, polarisation and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, transition moment, selection rules, intensity of spectral lines.

UNIT II

*Microwave Spectroscopy.*Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.

UNIT III

Infrared Spectroscopy. Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region.

UNIT IV

Raman Spectroscopy. Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle.Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).

UNIT V

Electronic Spectroscopy.Atomic Spectroscopy. Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms. *Molecular Spectroscopy.*Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules.Emission spectra; radiative and non-radiative decay, internal conversion, charge-transfer spectra.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand the concept Microwave, Infrared, Raman and Electronic spectroscopy and its applications.
- Develop an understanding of Atomic and Molecular spectroscopy.

SUGGESTED READING

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH Oxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. I SEM	Elective	Course MCH 105	Maths for Chemist and Computers *(Theory)*	Max: 40	Min: 14

COURSE OBJECTIVE:

- This course introduces the math content to chemistry students. It has been designed to complement lecture material with particular focus on the application of maths in chemistry.
- To enable students to learn and implement the basics of computer in chemical sciences.

.**UNIT - I**

Vectors. Vectors, dot, cross and triple products etc. gradient, divergence and curl, Vector Calculus.

Matrix Algebra. Addition and multiplication; inverse, adjoint and transpose of matrices.

UNIT- II

Differential Calculus. Functions, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.).

Integral calculus. Basic rules for integration, integration by parts, partial fractions and substitution. Reduction formulae, applications of integral calculus. Functions of several variables, partial differentiation, co-ordinate transformations (e.g. Cartesian to spherical polar).

UNIT - III

Elementary Differential equations. First-order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. second order differential equation and their solutions.

Permutation and Probability. Permutations and combinations, probability and probability theorems average, variance root means square deviation examples from the kinetic theory of gases etc., fitting (including least squares fit etc with a general polynomial fit.

UNIT-IV:

Basic structure of a computer: The CPU, the I/O devices, the internal memory, commonly used secondary storage media. Data representation: The software: Concept of low level and high level languages, Compiler interpreter, editor, operating system concepts, Windows operating systems, salient features of MS-office with special emphasis on MS Excel (graphs, tables, formulas)

UNIT-V:

Programme Development Process Algorithm, Flowchart, Decision-table, elements of high level programming languages. Input-output statements, conditional statements, control structure,

concept of data file, file operations like searching, storing, with reference to C/ C++ Programming.

COURSE OUTCOME

By the end of this course student will be able to-

- Understand fundamental concepts of Maths in the field of Chemistry and allied subjects.
- Build concepts in fundamental Maths which would bridge the gap between Chemistry and Physical sciences.
- Enhance understanding and applicability of concepts in varied fields of Physical, Chemical and Biological Sciences

SUGESTED READING

1. The chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suiclific, Logman.
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.
7. Mathematics for Chemists: Bhupendra Singh, Pragati Prakashan
8. Fundamentals of Computer : V. Rajaraman, Prentice Hall.
9. Computers in Chemistry : K.V. Raman, Tata Mc Graw Hill).
10. Computer Programming in FORTRAN IV-V Rajaraman, Prentice Hall.
11. Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
12. Computational Chemistry, A.C. Norris.
13. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
14. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. I SEM	Elective	Course MCH 105	Biology for Chemist and Computers	Max: 40	Min: 14

COURSE OBJECTIVE:

- This course introduces the Biology content to chemistry students
- To study the structure and organization of cell membrane and cell wall, process of membrane transport and membrane models.
- To enhance understanding and applicability of concepts in varied fields of Physical, Chemical and Biological Sciences.
- To enable students to learn and implement the basics of computer in chemical sciences.

UNIT - I

Cell Structure and Functions. Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview and their functions, comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism. ATP – the biological energy currency. Origin of life-unique properties of carbon chemical evolution and rise of living systems. Introduction to bio-molecules, building blocks of biomacromolecules.

UNIT - II

Carbohydrates. Conformation of monosaccharides, structure and functions of important derivatives of mono-saccharides like glycosides, deoxy sugars, myoinositol, amino sugars. Nacetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Structure and biological function of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.

UNIT - III

Amino-acids, Peptides and Proteins. Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins. Force responsible for holding of secondary structures. α helix, β sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and dominastructure. Quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination, chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

UNIT-IV:

Basic structure of a computer**:** The CPU, the I/O devices, the internal memory, commonly used secondary storage media. Data representation: The software: Concept of low level and high level languages, Compiler interpreter, editor, operating system concepts, Windows operating systems, salient features of MS-office with special emphasis on MS Excel (graphs, tables, formulas)

UNIT-V:

Programme Development Process Algorithm, Flowchart, Decision-table, elements of high level programming languages. Input-output statements, conditional statements, control structure, concept of data file, file operations like searching, storing, with reference to C Programming.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand fundamental concepts Biology in the field of chemistry and allied subjects.
- Build concepts in fundamental Biology which would bridge the gap between Chemistry and Physical /Biological sciences.
- Enhance understanding and applicability of concepts in varied fields of Physical, Chemical and Biological Sciences.

SUGESTED READINGS:

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley.
6. Fundamentals of Computer : V. Rajaraman, Prentice Hall.
7. Computers in Chemistry : K.V. Raman, Tata Mc Graw Hill).
8. Computer Programming in FORTRAN IV-V Rajaraman, Prentice Hall.
9. Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
10. Computational Chemistry, A.C. Norris.
11. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
12. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.

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St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. II SEM	Core	**MCH 201**	**Inorganic Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE

- To acquaint students with concept of symmetry and symmetry operations in chemistry.
- To develop advanced principles of bonding in inorganic compounds and their application.
- To develop an understanding of structure, bonding, properties and applications of boranes, borazines, carboranes, metallo carboranes and Metal nitrosyls

UNIT I

Reaction Mechanism of Transition Metal Complexes III.: Substitution reaction without Metal – Ligand bond cleavage. Oxidtion reduction reactions through group transfer, through electron transfer, Innersphere and outersphere mechanism, 2 electron transfer reactions, Distinguish between Innersphere and Outersphere, factors affecting electron transfer reaction, Marcus –Hush theory

UNIT II

Metal Pi-Complexes. Metal carbonyls: structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation. Dioxygen complexes, Wilkinson's catalyst

UNIT III

Borane Chemistry Metal Clusters. Bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for B_2H_6, B_4H_{10}, B_5H_9, B_5H_{11} and B_6H_{10} and their utilities. Acquaintance with carboranes and metallocarboranes. Metal clusters: synthesis, reactivity and bonding.

UNIT IV

.*Electronic Spectra and Magnetic Properties of Transition Metal Complexes.* Calculations of Dq, B and β parameters for Cr(III), Co(II) and Ni(II) complexes using electronic spectral data. Charge transfer spectra: ligand to metal and metal to ligand.

UNIT V

Metal Pi-Complexes. Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and x-ray diffraction studies of metal nitrosyls for bonding and structure elucidation, important reactions of transition metal nitrosyl complexes pertaining to potentiality in air pollution control, biomedical applications. Dinitrogen complexes, Vaska's compound

COURSE OUTCOME

By the end of this course student will be able to-

- Gain a thorough knowledge about Metal carbonyls and nitrosyls and their applications.
- Develop the concept of reaction mechanism in transition metal complexes and factors affecting the reactions in substitution reactions and electron transfer reactions
- Build the concept of Borane chemistry and metal clusters and their applications.

SUGGESTED READING

1. Raman, K.V. (2002). Group Theory and its Applications to Chemistry. New Delhi: Tata McGraw Publishing Company.
2. Cotton, F. A. (2003). Chemical Applications of Group Theory (III Edition). Texas: A Wiley Inter Science Publication.
3. Veera Reddy, K. (2009). Symmetry and Spectroscopy of Molecules. New Delhi: New Age International Pvt. Ltd.
4. Huheey, J. E., Keitler, E. A., & Keitler, R. L. (2012). Inorganic ChemistryPrinciples of Structure and Reactivity (IV Edition). Singapore: Pearson Education.
5. Malik. Wahid. U, Tuli. G. D and Madan, R.D. (2009). Selected Topics in Inorganic Chemistry New Delhi: S. Chand and Co.
6. Sarn, K. (2005). Co-ordination Chemistry.(Ist Edition) New Delhi: Rajat Publications.
7. Catherine, E. H., & Alan G. S. (2012). Inorganic Chemistry (IV Edition). England: Pearson Education Limited, Harlow.
8. Cotton, F. A., Wilkinson, G., & Paul. L. (2007). Basic Inorganic Chemistry (III Edition). New York: John Wiley & Sons. 6. Chakraburty, D. K. (2012). Inorganic Chemistry. (II Revised Edition) New Delhi: New Age International Publishing Pvt. Ltd.

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. II SEM	Core	Course MCH 202	Organic Chemistry	Max: 40	Min: 14

COURSE OBJECTIVE:

- To understand mechanistic and stereochemical aspects of addition reactions, versatile knowledge of different some named reactions and their application in organic synthesis.
- To learn about some familiar addition and elimination reactions and their reaction mechanisms
- To gain knowledge about pericyclic reactions, their mechanism and symmetry properties

UNIT I

Free Radicals. Free radical reactions and their stereochemistry. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, hydroperoxide formation, replacement of diazoniumgroup. Hunsdiecker reaction.

UNIT II

Addition to Carbon-Carbon Multiple Bonds. Mechanistic and stereochemical aspects of addition reactions. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation. *Addition to Carbon-Hetero atom Multiple Bonds.* Mechanism of metal hydride reduction of carbonyl compounds, acids, esters and nitriles. Wittig reaction. Mechanism of condensation reactions involving enolates. Mannich, Benzoin, Perkin, and Stobbe reactions.

UNIT III

Elimination Reactions. The E2, E1 and E1cB mechanisms and their spectrum. Orientation of the double bond. Reactivity, effect of substrate structure, attacking base, the leaving group and the medium. Elimination *versus* substitution. Mechanism and orientation in pyrolytic elimination. The Hofmann degradation. Dihalo-elimination. Decomposition of toluene-p-sulphonyl hydrazones. Conversion of ketoximes to nitriles. *N*-Nitrosoamine to diazoalkane transformation

UNIT IV

Pericyclic Reactions: Part I. Molecular orbitals and their symmetry. Molecular orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system, and their symmetry properties.

Pericyclic reactions. Characteristics and classification. Electrocyclic reactions: conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Woodward-Hoffmann correlation diagrams. FMO and PMO approach.

UNIT V

Pericyclic Reactions: Part II. Cycloaddditions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Antarafacial and suprafacial additions.4n and 4n+2 systems, 2+2 addition of ketenes. Ene synthesis.

Sigmatropic Rearrangements. Suprafacial and antarafacial 1,3- and 1,5- shifts of H, sigmatropic shifts involving carbon moieties, 2,3-, and 3,3-sigmatropic rearrangements. Claisen, Cope, aza-Cope, Sommlet-Hauser, and Fisher Indole rearrangements.

Course Outcome:

By the end of this course student will be able to-

- Understand concepts of the pericyclic reactions and their symmetry properties.
- Enhance the knowledge about Elimination reactions, mechanism and some known examples.
- Procure an in-depth knowledge about free radical reactions and the mechanism of some known reactions.
- Build concepts of addition reactions to carbon –carbon and carbon –hetero atom multiple bonds and some famous named reactions.

SUGGESTED READINGS

1. Smith, M. B. (2015). March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure (VII Edition). New Jersey: John Wiley & Sons, Inc., Hoboken.

2. Peter Sykes, (1995). A guidebook to mechanism in Organic Chemistry (VI Edition). New York: John Wiley & sons Inc.

3. Sanyal, S. N. (2014). Reactions, Rearrangements and Reagents (IV Edition). New Delhi: Bharathi Bhawan (Publishers and Distributors).

4. Tewari, N. (2011). Advanced Organic Reaction Mechanism (III Edition). Kolkata: Books and Allied (P) Ltd.

5. Clayden, J., Greeves, N. & Warren, S. (2012). Organic Chemistry (II Edition). Oxford University Press, Oxford

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. II SEM	Core	Course MCH 203	**Physical Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

To understand the general features of chemical dynamics, advanced concept of Adsorption, in-depth knowledge of Applied electrochemistry, corrosion and its applications.

UNIT I

Chemical Dynamics(Part III). General features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of molecular motions and of barrierless chemical reactions in solution, probing the transition state. Dymanics of unimolecular reactions; Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus and Slater theories of unimolecular reactions.

UNIT II

Adsorption. Surface tension, capillary action, pressure difference across curved surface, Laplace equation, vapour pressure of droplets, Kelvin equation; Gibbs adsorption isotherm. Multilayer adsorption, BET equation. Calculation of surface area, catalytic activity at surfaces. Surface films on liquids; electrokinetic phenomena; surface active agents. Micellisation, hydrophobic interaction. Critical micellar concentration. Solubilisation. Donnan's membrane equilibria.

UNIT III

Electrochemistry of solutions. Debye-Huckel -Onsager treatment and its extension to concentrated solutions. Ion size factor and ion-solvent interactions. Concept of activity. Determination of mean ionic activity and activity coefficient. *Lippmannn electrocapillary phenomenon.* Electrocapillary curves of mercury and their interpretation. Structure of electrified interfaces. Helmholtz, Guoy and Chapmann and Stern models. Introductory idea of advancements in electrified surfaces. Electrokinetic potential, its determination and significance.

UNIT IV

Irreversible electrode phenomenon. Decomposition voltage and overvoltage. Consecutive electrode processes. Exchange current density. Butler-Volmer's equation. Tafel's plot. Theory of polarography. Ilkovic equation. Half wave potential and its significance.Introduction to corrosion. Forms of corrosion. Corrosion monitoring and prevention

UNIT V

Applied Electrochemistry Electrochemistry: Nernst equation, electrode kinetics, electrical double layer, Debye-Huckel theory. Voltammetry, Current voltage relationship, Characteristic of DME, Half wave potential. Amperometric titrations.

Course Outcome:

By the end of this course student will be able to-

- Understand Applied electrochemistry, corrosion and its applications
- Develop an understanding of the electrochemistry of solutions, irreversible electrode phenomenon and its applications,
- Procure an in-depth knowledge about adsorption phenomenon, its theories and applications.
- Understand and apply the concepts of chemical dynamics to fast reactions, unimolecular reactions and molecular motions.

SUGGESTED READINGS:

1. Glasstone, S. (2008). Thermodynamics for Chemists. New York: Litton Edition Publishing.

2. Atkins, P., & De Paula, J. (2014). Atkins Physical Chemistry (X Edition). Oxford: Oxford University Press. 3. Kapoor, K. L. (2015). Text Book Physical Chemistry Vol. V. New Delhi: MacMillan India Ltd.

4. Lavin, I. N. (2002). Physical Chemistry (V Edition). New Delhi: Tata-McGraw Hill Publishing Company.

5. Whittakar, A. G. (2001). Physical Chemistry. New Delhi: Mount & Heal Viva Books Pvt. Ltd.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. II SEM	Core	Course MCH 204	**Spectroscopy –II**	Max: 40	Min: 14

COURSE OBJECTIVE:

To understand the theories of NMR, FT-IR, Photoelectron Spectroscopy, ESR spectroscopic techniques, their principle, instrumentation and applications.

UNIT –I

Infrared and Raman Spectroscopy. Instrumentation and sample handling. Calculation of vibrational frequencies. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, carbonyl compounds, alcohols, ethers, amines, phenols and aromatic compounds. Finger-print region. Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance.FT-IR.Resonance Raman effect.Concept and factors that influence group frequencies.

UNIT- II

Electronic Spectroscopy and its applications. Electromagnetic radiation, wavelength, wave number, frequency, and energy calculation. Electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, Fieser-Woodward rules for conjugated dienes and carbonyl compounds. *Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD).*Concept of ORD and CD, deduction of absolute configuration, octant rule for ketones.

UNIT -III

Nuclear Magnetic Resonance Spectroscopy. ^{1}H-NMR phenomenon. Chemical shift, shielding and deshielding mechanism, mechanism of measurement, chemical shift values and its correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto). Chemical exchange, effect of deuteration. Spin-spin coupling (first order spectra; AX, AB, AMX spectra).Coupling constant, Karplus curve. Complex spin-spin interactions. Simplification of complex spectra, nuclear magnetic double resonance, increased field strength, contact shift reagents. Nuclear Overhauser effect (NOE). FT technique.

Nuclear Magnetic Resonance Spectroscopy. *NMR Shift reagents, shift mechanism and its utility in simplification of NMR spectra. Applications of NMR in characterization of coordination compounds*

UNIT -IV

Electron Spin Resonance Spectroscopy. Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the g value. Hyperfine coupling. Double resonance in esr. Spin Hamiltonian relationship, measurement techniques, applications.

UNIT- V

Photoelectron Spectroscopy. Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA.Auger electron spectroscopy -basic idea.

Photoacoustic Spectroscopy. Basic principles of photoacoustic spectroscopy (PAS), chemical and surface applications

Course Outcome:

By the end of this course student will be able to-

- Understand organic spectroscopy, its types and applications in structure elucidation and identification.
- Develop an understanding of Infrared, Raman and Electronic spectroscopy and its applications.
- Develop an understanding of Nuclear Magnetic Resonance and its applications.
- Build the concept of Photoelectron spectroscopy and photoacoustic spectroscopy and its applications in structure elucidation.

SUGGESTED READING

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience.
3. Physical Methods in Chemistry, R.S. Drago, Saunders College.
4. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.
5. Basic Principles of Spectroscopy, R. Chang, McGraw Hill.
6. Introduction to Photoelectron Spectroscopy: P. K. Ghosh, John Wiley.
7. Macromolecules: Structure and Function, F. Wold, Prentice Hall.
8. Fundamentals of molecular spectroscopy, C.N. Banwell, Tata McGraw-Hill, New Delhi.
9. Instrumental Methods of Analysis, Willard, Meritt and Dean.

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Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. II SEM	**Elective (A)**	Course MCH 205	**Analytical Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

To provide the students an in-depth account of various modern analytical techniques like spectrophotometry, XRD, AAS, thermal and electroanalytical techniques and Chromatography, their principles, instrumentation and applications

UNIT I

Statistical Analysis .Emphasis should be placed on numerical problems. Significant figures. Accuracy and precision. Errors, systematic and random errors. Propagation of errors. Standard deviation. Coefficient of variation. Confidence limit. Significance test.t-Test, F-Test. Rejection of a result. The least-squares method for deriving calibration graph. Correlation coefficient. Limit of detection.

Sample Preparation for Chromatography. Solid-phase extraction, solid-phase microextraction. Extraction with molecular imprinted polymers.

UNIT II

Chromatography. Theory of Chromatography. Retention time. Capacity factor. Number of theoretical plates, and plate height. Band broadening. Van Deemter equation. Column resolution. *Gas Chromatography.* Instrumentation. Columns. Detection: flame ionisation detector, thermal conductivity detector and mass spectrometric detector.

High-Performance Liquid Chromatography. Instrumentation. Pumping systems. Sample injection system. Columns. Detection: UV-Vis detector, photodiode array detector, fluorescence detector, refractive index detector and mass spectrometric detection. *Capillary Electrophoresis.* Principle, modes of operation, and instrumentation.

UNIT III

Ion Exchange. Cation and anion exchangers. Action of ion exchange resins. Ion exchange equilibria and ion exchange capacity. Strongly and weakly acidic cation exchangers. Strongly and weakly basic anion exchangers. Liquid ion exchangers. Ion chromatography. Conductivity detection using suppressor column. *Solvent Extraction.* The distribution coefficient. Factors favouring solvent extraction. Extraction reagents. Synergetic effects. Ion-pair extraction. Extraction and stripping. Solvent extraction with crown ethers, and factors influencing it.

UNIT IV

Atomic Absorption Spectrometry. Principle. Instrumentation. Flame atomization. Hollow-cathode lamps. Inductively coupled plasma-mass spectrometry. *Electrolytic Methods.*

Fundamentals of the techniques: Voltammetry. Polarography. Differential pulse polarography. Cyclic voltammetry. Anodic stripping analysis.

UNIT V

Acid-Base Titrations. Kjeldahl method for determination of nitrogen. Determination involving acetylation (amino and hydroxyl groups); and oximation (carbonyl group).*Precipitation Titrations* .Argentometric titrations. Mohr titration. Volhard titration. Fajan titration. *Complexometric Titrations.* Titration with EDTA. Indicators for EDTA titrations. Titration methods: direct and back titrations, and displacement methods. Masking and demasking .agents, and their use in EDTA titrations Redox Titrations. Determination of 1,2-diols by periodate oxidation. Karl Fischer titration of water. Determination of DO,BOD and COD.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand analytical chemistry and various techniques.
- Develop an understanding of High Performance Liquid chromatography, Gas Chromatography, its theories and applications.
- Understand Ion exchange Chromatography and Solvent extraction and its theories and applications.
- Develop an understanding of Acid Base Titrations, its types and uses in analytical chemistry.

SUGGESTED READINGS

1. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, Fundamentals of analytical chemistry, Thomson Brooks/Cole, Singapore.
2. D.C. Harris, Quantitative chemical analysis, W.H. Freeman and Co., New York.
3. J.D. Christian, Analytical Chemistry, Wiley, New York.
4. Principles and Practice of Analytical Chemistry, F.W. Fifield and D. Kealey, Blackwell Publishing.
5. S.M. Khopkar, Basic concepts of analytical chemistry, Wiley Eastern, New Delhi.
6. S.M. Khopkar, Analytical chemistry of macrocyclic and supramolecular compounds, Narosa Publishing House, New Delhi.
7. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. II SEM	Elective B	Course MCH 205	**Photochemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

- To enrich the students with the understanding of photochemical reactions, their mechanisms and applications.
- To develop an understanding of photochemistry of alkenes, aromatic compounds, carbonyl compounds and miscellaneous reactions and their applications.

UNIT-I

Photochemical Reactions. Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

UNIT- II

Determination of Reaction Mechanism. Classification, rate constants and life times of reactive energy state determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis.

UNIT III

Photochemistry of Alkene. Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes.

Photochemistry of Aromatic Compounds .Isomerisations, additions and substitutions.

UNIT IV

Photochemistry of Carbonyl Compounds. Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, unsaturated and α,β-unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

UNIT V

Miscellaneous Photochemical Reactions. Photo-Fries reactions of annelid's, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photodegration of polymers. Photochemistry of vision.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand photochemical reactions, mechanisms and applications in organic chemistry
- Develop an understanding of photochemistry of alkenes, aromatic compounds, carbonyl compounds

SUGGESTED READINGS

1. Fundamentals of Photochemsitry, K.K.Rohtagi-Mukherji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A.Gilbert and Baggott, Blackwell Scientific Publications.
3. Molecular Photochemsitry, N.J. Turro, W.A.Benjamin.
4. Introductory Phtochemistry, A. Cox and T. Camp, McGraw-Hill. 6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. III SEM	Core	**Course MCH 301**	**Inorganic Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

To provide an overview of group theory, enhance the knowledge of reaction mechanism of transition metals, theory, principle and applications nanomaterials, ESR and *Mössbauer Spectroscopy*.

UNIT-I

Symmetry criterion of optical activity, symmetry restrictions on dipole moment. A systematic procedure for symmetry classification of molecules. Concepts of Groups, Sub-groups, Classes of Symmetry operations, Group Multiplication Tables. Representation of Groups: Matrix representation of symmetry operations, reducible and irreducible representations

UNIT-II

Group theory and vibrational Spectroscopy.Group theory to symmetry, shapes and molecular energy level diagrams of molecules like BF_3, NH_3 (AB_3 type), $[Pt(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$ (AB_4 type) and $[Co(NH_3)_6]^{3+}$ (AB_6 type) molecules. Modes of bonding of ligands such as SCN^-, □-ketoenolate and related ligands, nitrate ion and corboxylates

Application of group theory to Spectroscopy.Use of group theory in predicting IR and Raman active modes in some simple molecules of C_{2v}, C_{3v} and $D_{□h}$ point groups.

UNIT-III

Nanomaterials: Preparative methods: Chemical methods, Solvothermal, Combustion synthesis, Microwave, Co-precipitation, Langmuir Blodgett(L-B) method, Biological methods: Synthesis using microorganisms.

Ceramics- Ceramic Structures, mechanical properties, clay products. Refracrtories, characterization, properties and applications.

Microscopic Composites dispersion strengthened and particle reinforced composites, macroscopic composites.

UNIT IV

Electron Spin Resonance Spectroscopy. Basic principles, hyperfine and superhyperfine splitting, g value and factors affecting g values, applications to transition metal complexes.

UNIT V

Mössbauer Spectroscopy. Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds -nature of M-L bond, coordination number, structure and (3) detection of oxidation state

COURSE OUTCOME:

By the end of this course student will be able to-

- Gain a thorough knowledge about Group theory and applications to molecules.
- Build the concept of Electron Spin Resonance and Mossbauer Spectroscopy and their application in structure elucidation.

SUGGESTED READINGS

1. Jag Mohan. (2018). Organic Spectroscopy: Principle and Applications (II Edition). New Delhi: Narose Publishing House.

2. Kemp, W. (2017). Organic Spectroscopy (III Edition). New York: Palgrave Macmillan.

3. Sharma, Y. R. (2013). Elementary Organic Spectroscopy: Principles and Chemical Applications (Revised V Edition). New Delhi: S. Chand & Company Limited.

4. Silverstein, R. M., Webster, F. X., & Kiemle, D. (2014). Spectroscopy of Organic Compounds (VIII Edition). New York: John Wiley & Sons.

5. Levine, I. N. (2013). Quantum Chemistry (VII Edition). New Delhi: Pearson Education Pvt. Ltd.

6. Drago, R.S. (2012). Physical Methods in Inorganic Chemistry. New York: East- West Press Pvt. Ltd.

7. Banwell.,(2017). Fundamentals of Molecular & Spectroscopy (IV Edition), McGraw-Hill Education (India) Pvt. Limited

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. III SEM	Core	Course MCH **302**	**Physical Chemistry**	Max: 40	Min: 14

COURSE OBJRCTIVE:

To understand the concept of Molecular orbital theory, Crystal defects, *ElectronicProperties and Band Theory.*

UNIT I

*Electronic Structure of Atoms.*Electronic configuration, Russell-Saunders terms and coupling scheme, Slater parameters, magnetic effects.Zeeman splitting; virial theorem.

UNIT II

*Molecular Orbital Theory.*Hückel theory of conjugated systems, bond order and charge density calculations. Applications to ethylene, butadiene, and cyclobutadiene.Introduction to extended Hückel theory.

UNIT III

*Homogeneous Catalysis.*Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerisation of olefins.

*Heterogenous Catalysis.*Thermodynamics of active centres, mechanism of heterogenous catalysis; structural promotion and structural modification.

UNIT IV

*Crystal Defects.*Perfect and imperfect crystals, stoichiometric and non-stoichiometric defects.Intrinsic and extrinsic defects, point defects, line and plane defects; Schottky and Frenkel defects.

*Solid State Reactions.*General principles, coprecipitation as a precursor to solid state reactions, factors affecting solid state reactions.

UNIT V

*Electronic Properties and Band Theory.*Metals, insulators and semiconductors.Electronic structure of solidsBand theory; band structure of metals, insulators and semiconductors.Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.

Course Outcome:

By the end of this course student will be able to-

- Develop concepts of Electronic Structure of Atoms and Molecular Orbital Theory and their applications.
- Enhance the knowledge about Homogenous and Heterogenous Catalysis.
- Develop an understanding of the Crystal defects and Solid state Reactions
- Build concepts of Electronic Properties and Band theory, types and applications on insulators, semiconductors and superconductors.

SUGGESTED READINGS

1. Bahl, A., Bahl, B. S., & Tuli, G. D, (2014). Essentials of Physical Chemistry (VEdition). New Delhi: S. Chand & Company.

2. Puri, B.R., Sharma, L.R., & Pathania, M.S. (2015). Elements of Physical Chemistry. Jalandhar: Vishal Publishing House.

3. Laidler, K. J. (2004). Chemical Kinetics (III Edition). New Delhi: Pearson Education Publishing. Indian Branch.

4.Gurdeep Raj, Chemical Kinetics, Goel Publishing House.

5. A.A.Frost and R.G.Pearson, Kinetics and Mechanism, Wiley Eastern, Pvt. Ltd.

6. Emmet, P. H. (1954). Catalysis (Vol I and II). Reinhold

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. III SEM	Core	Course MCH 303	**Spectroscopy III**	Max: 40	Min: 14

COURSE OBJECTIVE:

To understand the principle, theories, instrumentation and applications of C^{13}NMR, Mass, Electron diffraction and neutron diffraction spectroscopic techniques

UNIT I

^{13}C-NMR Spectroscopy General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), wide band H-decoupled and off-resonance H-decoupled spectra. Calculation of chemical shift values for alkanes and substituted benzene. Two dimension NMR spectroscopy. COSY, and DEPT techniques. *Conjoint Spectroscopy Problems.* Application of UV, IR, Raman, NMR and Mass spectrometry for elucidation of structure of organic compounds.

UNIT II

Mass Spectrometry-Part I. Ion production, electron ionisation (EI), chemical ionisation (CI), field desorption (FD), field ionisation (FI), and fast atom bombardment (FAB). Atmospheric pressure ionisation techniques. Electrospray ionisation, and atmospheric pressure chemical ionisation. Thermospray ionisation. Matrix assisted laser desorption ionisation (MALDI). Mass analysers. Magnetic sector analysers. Quadrupolar analysers, ion trap, time-of-flight (TOF), ion cyclotron resonance (ICR).Electron multiplier. Tandem mass spectrometry (MS/MS).

UNIT III

*Mass Spectrometry-Part II.*Isotopic abundance. Electron ionisation and fragmentation (positive ions).Molecular ion peak, metastable peak. McLafferty rearrangement. Nitrogen rule. Parity rule. Mass spectral fragmentation of organic compounds containing common functional groups (alkanes, alkenes, alkynes, halo-compounds, alcohols, amines, carbonyl compounds, aromatic compounds).

High resolution mass spectrometery. Interpretation of mass spectra. Problems based on mass spectrometry of organic compounds.

UNIT IV

X-ray Diffraction. Bragg condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density. Description of the procedure for an X-ray structure analysis.

UNIT V

Electron Diffraction. Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules.Low energy electron diffraction and structure of surfaces.

Neutron Diffraction. Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand C13 NMR and its application in structure elucidation.
- Build concepts of Mass spectrometry, its techniques, applications and interpretation of spectra.
- Understand and apply the concepts of X Ray, Electron and Neutron diffraction, its types and applications for structure elucidation of organic compounds
- Develop an understanding of Conjoint Spectroscopy for elucidation of structure of organic compounds using UV, IR, Raman, NMR and Mass Spectroscopy.

SUGGESTED READINGS

10. Modern Spectroscopy, J.M. Hollas, John Wiley.
11. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience.
12. Physical Methods in Chemistry, R.S. Drago, Saunders College.
13. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.
14. Basic Principles of Spectroscopy, R. Chang, McGraw Hill.
15. Introduction to Photoelectron Spectroscopy: P. K. Ghosh, John Wiley.
16. Macromolecules: Structure and Function, F. Wold, Prentice Hall.
17. Fundamentals of molecular spectroscopy, C.N. Banwell, Tata McGraw-Hill, New Delhi.
18. Instrumental Methods of Analysis, Willard, Meritt and Dean.

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Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. III SEM	**Elective** A	**Course MCH 304**	**Medicinal Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE

- To understand the basics of Medicinal chemistry, drug targets, drug metabolism, membrane and receptors in drug delivery process.
- To apply the various theories of Drugs, their mechanism and mode of action for various kinds of drugs

UNIT I

Structure and activity. Relationship between chemical structure and biological activity (SAR).Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.

UNIT II

Pharmacodynamics. Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

UNIT III

Antibiotics and antibacterials. Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular . Streptomycin, Broad spectrum antibiotics .Tetracyclines, Anticancer – Dactinomycin (Actinomycin D)

UNIT IV

Antifungal polyenes, Antibacterials. Ciprofloxacin, Norfloxacin, Antiviral. Acyclovir Antimalarials. Chemotherapy of malaria. SAR.Chloroquine, Chloroguanide and Mefloquine

UNIT V

Non-steroidal Anti-inflammatory Drugs. Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents: Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand Medicinal Chemistry and its application in pharmaceutical chemistry.
- Develop an understanding of Structure and Reactivity, Pharmocodynamics in Drug Design, Metabolism and Development.
- Enhance the knowledge about Antibiotics, Antibacterials, Antifungals and NSA Drugs their structure, synthesis, mode of action, advantages and disadvantages.

SUGGESTED READINGS

1. Ahluwalia, V. K. (2012). Green Chemistry-Environmentally Benign Reactions. New Delhi: Ane Books Pvt Ltd.

2. Ghose, J. (2012). A Text book of Pharmaceutical Chemistry. New Delhi: S. Chand Pub Ltd.

3. Ilango, K., & Valentina, P. (2017). Text Book of Medicinal Chemistry. Vol II. Chennai: Keerthi Publishers.

4. Ashutosh Kar, (2018). Medicinal Chemistry (III Edition). New Delhi: New Age International Publishers. 5. Stanley E. Manahan, (2006). Green Chemistry and the Ten Commandments of Sustainability (II Edition). Columbia, Missouri U.S.A: ChemChar Research. Inc Publishers Columbia.

6. Chatterjea, M. N., & Shinde, R. (2012). Textbook of Medicinal Biochemistry. New Delhi: Jaypee Brothers. Medical Publishers (P) Ltd. 7. G.L. Patrick, (2013). Introduction to Medicinal Chemistry (I Edition). UK: Oxford University Pre

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. III SEM	**Elective** B	**Course MCH 304**	**Chemistry of Natural Products**	Max: 40	Min: 14

COURSE OBJECTIVE

To understand the importance of natural products, their structure, synthesis and applications.

UNIT I

*Terpenoids.*General methods of structure elucidation. Isoprene rule.Structure determination, stereochemistry, and synthesis of the following representative molecules: citral, geraniol, α-terpineol, menthol, α-pinene, camphor, and abietic acid. Biosynthesis of terpenoids.

UNIT II

*Alkaloids.*General methods of structure elucidation. Structure determination, stereochemistry, and synthesis of the following representative molecules: ephedrine, nicotine, atropine, quinine and morphine. Biosynthesis of alkaloids.

UNIT III

Steroids. Structure elucidation, stereochemistry and chemical synthesis of cholesterol, bile acids, androsterone, testosterone, estrone, progestrone and aldosterone. Biosynthesis of steroids.

UNIT IV

*Plant Pigments.Carotenoids.*Structure and synthesis of β-carotene. *Flavonoids.*Nature, general methods for structure elucidation and synthesis of anthocyanins and flavones.Structure and synthesis of cyanidin chloride, cyanin, flavone, flavonol and quercetin.Biosynthesis of flavonoids.*Chlorophyll.*Chemistry of chlorophyll.

UNIT V

*Vitamins and Antibiotics.Vitamins.*Structure and synthesis of vitamin B_1 (thiamine), B_2 (riboflavin) and B_6 (pyridoxine).Chemistry of Vitamin B_{12}. *Antibiotics.*Structure and synthesis of penicillins and chloramphenicol.

Course Outcome:

By the end of this course the student will be able to

- Understand Chemistry of Natural Products and their application in pharmaceutical chemistry.
- Develop an understanding of Alkaloids, Steroids, Carotenoids, Vitamins, Flavonoids and Antibiotics, their structure, synthesis and applications.

SUGGESTED READINGS:

1. Chatwal, G. R. (2015). Organic Chemistry of Natural Products Vol. II. New Delhi: Himalaya Publishing House.

2. Finar, I. L. (2013). Organic Chemistry Vol. II: Stereochemistry and the Chemistry of Natural Products (V Edition). New Delhi: Pearson Education, Ltd.

3. Chatwal, G. R. (2015). Organic Chemistry of Natural Products. Vol. I. New Delhi: Himalaya Publishing House.

4. Saluja, M. P., Raj Kumar & Anuja Agarwal (2017). Advanced Natural Products (Revised IV Edition). Meerut: Krishna Prakashan Media (P) Ltd.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. III SEM	**Elective C**	**Course MCH 304**	**Polymers**	Max: 40	Min: 14

COURSE OBJECTIVE:

- To enable the student to get knowledge about the basic concepts of polymerization, and classification.
- To provide knowledge about properties, structure, processing techniques and applications of commercial polymers.

UNIT I

Basics of Polymers. Repeating units, degree of polymerisation, linear, branched and network polymers. Classification of polymers. Addition, radical, ionic, coordination and condensation polymerisation; their mechanism and examples.

Polymerisation conditions and polymer reactions. Polymerisation in homogeneous and heterogeneous systems.

UNIT II

Polymer Characterisation. Significance of molecular weight of polymer. Polydispersive average molecular weight. Number, weight and viscosity average weights. Measurement of molecular weights. End group, viscosity, light scattering, osmotic and ultracentrifugation methods. Chemical and spectroscopic analysis of polymers.X-Ray diffraction study. Thermal analysis, tensile strength, fatique, impact. Tear resistance. Hardness and abrasion resistance.

UNIT III

Structure and Properties. Configuration of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers. Polymer structure and physical properties; crystalline melting point Tm, melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tg relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.

UNIT IV

Polymer Processing. Plastics, elastomers and fibres. Compounding. Processing techniques, Calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT V

Properties of Polymers. Properties of polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers. Fire retarding polymers, and electrically conducting polymers. Biomedical polymers. Contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

COURSE OBJECTIVE:

By the end of this course student will be able to-

- Create an understanding Polymer Chemistry and its industrial applications.
- Develop an understanding of Polymer basics and characterization, its structure and properties.
- Understand the Polymer processing and their properties and applications in biomedical field.

SUGGESTED READINGS

1. Billmeyer, F. W. (2003). Text Book of Polymer Science (III Edition). New York: John Wiley.
2. Alcock, H. R., Lampe, F. W., & Mark, J. E. (2003). Contemporary Polymer Chemistry (III Edition). NJ: Prentice Hall Englewood Cliffs.
3. Flory, P. J. (1953). Principles of Polymer Chemistry. New York: Cornell University Press.
4. Odian, G. (2004). Principles of Polymerization (IV Edition). New York: John Wiley & Sons.
5. Textbook of Polymer Science, F.W. Billmeyer, Jr., Wiley.
6. Polymer Science, V.R. Gwariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern.
7. Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R.M. Ottanbrite.
8. Contomporary Polymer Chemistry, H.R. Alcock and F.W. Lambe, Prentice Hall.
9. Physics and Chemistry of Polymers, J.M.G. Cowie, Blackie Academic and Professional.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	Core	**Course MCH 401**	**Inorganic Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE: To enable the students in understanding various Aspects of Bioinorganic chemistry, Electron Transfer in Biology, organic reagent in organic chemistry, Photosystems and energy transfer concept

Unit-I

Organic Reagents in Inorganic Chemistry: Chelation, factors determining the stability of

chelates (effect of ring size, oxidation state of the metal, coordination number of the metal); Use ofthe following reagents in analysis:

(a) Dimethylglyoxime (in analytical chemistry)

(b) EDTA (in analytical chemistry)

(c) 8-Hydroxyquinoline (in analytical chemistry)

(d) 1,10-Phenanthroline (in analytical chemistry)

(e) Thiosemicarbazones (in analytical chemistry)

(f) Dithiazone (in analytical chemistry)

UNIT II

Bioinorganic Chemistry. Metal containing enzymes: Carboxypeptidase-A, Carbonic anhydrase, arginase, urease, DNA polymerase, phosphoglucomutase (glucose storage): structure and reactivity

UNIT III

Bioinorganic Chemistry: Metal complexes in transmission of energy: Chlorophylls, photosystem-I and photosystem-II in cleavage of water, model systems.

UNIT IV

/Electron Transfer in Biology: Structure and function of metalloproteins in electron transport processes-cytochromes and ion-sulphur proteins. Nitrogenase: Biological nitrogen fixation, molybdenum nitrogenase-structure and function.

UNIT V

Transport and Storage of Dioxygen Structure and function of haemoglobin, myoglobin, hemocyanin and hemerythrin. Poisoning towards haemoglobin and myoglobin.

COUSE OUTCOME:

By the end of this course student will be able to-

- Gain a thorough knowledge about Organic Reagents in Inorganic Chemistry, their structure and applications
- Develop the concept of Bioinorganic Chemistry, metal containing enzymes and metal complexes in energy transmission.
- Build the concept of Electron transfer in Biology, transport and storage of dioxygen.

SUGGESTED READINGS

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic Biochemistry vols I and II. ed. G.L. Eichturn, Elsevier.
4. Progress in Inorganic Chemistry, Vols 18 and 38 ed. J.J. Lippard, Wiley, Environmental Chemistry, S. E. Manahan, Lewis Publishers.

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. IV SEM	Core	Course MCH 402	Organic synthesis strategies	Max: 40	Min: 14

COURSE OBJECTIVE

- To enable students to know various strategies used in retro synthetic analysis, chemistry of various organic reagents and the chemistry of Oxidation and Reduction reactions
- To understand basics of asymmetric synthesis, chemistry of various reagents, reaction and mechanism of selected named reactions, the chemistry of protecting and deprotecting groups and synthesis of selected drug molecules.

UNIT I

Oxidation. Oxidation of carbon carbon double bond. Perhydroxylation, potassium permanganate, osmium tetroxide, iodine together with silver carboxylates, ozonolysis. Enantioselective epoxidation of allylic alcohols (Sharpless epoxidation).Oxidation of alcohols. Chromic acid, chromiun (VI) oxide-pyridine complexes, manganese (IV) oxide, silver carbonate, oxidation via alkoxy sulphonium salts. Baeyer-Villiger oxidation of ketones. Oxidation with ruthenium tetroxide, thallium(III) nitrate and iodobenzene diacetate.

UNIT II

Reduction. Catalytic hydrogenation (homogeneous and heterogenous).Stereochemistry and mechanism, selectivity of reduction.Reduction by dissolving metals. Metal and acid, metal and alcohol, metal and ammonia.

Reduction by hydride-transfer reagents.Aluminium alkoxides, lithium aluminium hydride, sodium borohydride, lithium hydrido-alkoxyaluminates.Wolff-Kishner reduction. Reduction with di-imide

UNIT III

Designing organic synthesis. The Disconnection Approach. Basic principles, synthons, functional group interconversions. Order of events in organic synthesis. One group CX disconnections and two group CX disconnections. Chemoselectivity. Reversal of polarity (umpolung). Amine synthesis

UNIT IV Organic reagent

Organic Reagents: Reagents in organic synthesis: Willkinson catalyst, Lithium dialkylcuprates(Gilman's reagents), Lithium diisopropylamide (LDA), 1,3-Dithiane (Umpolung) Dicyclohexylcarbobiimide (DCC), and Trimethylsilyliodide, DDQ, SeO2, Baker yeast, Tri-nbutyltinhydride, Nickel tetracarbonyl, Trimethylchlorosilane

UNIT V

Rearrangment General mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Backmann, Hofmann, Curtius, Schmidt, Benzidine, Baeyer-Villiger, Shapiro reaction, Witting rearrangement and Stevens rearrangement.

COURSE OUTCOME

By the end of this course student will be able to-

- Create an understanding Organic Synthesis Strategies and its application.
- Gain knowledge about concept of Oxidation, Reduction and Rearrangement reactions and their applications to some known reactions.
- Develop an understanding Disconnection approach, types and chemoselectivity.

SUGGESTED READINGS

1. Warren,S. (2010). Organic Synthesis the Disconnection approach, Wiley and sons,

2. Renuga,S. (2016). Name reactions and reagents in organic synthesis, Vishal Publishing Co. Jalandhar-Delhi.

3. Nasir Hussain and Saba Khan, (2016). Reactions and Reagents, Himanshu Publications, New Delhi.

4. Clayden, J., Greeves, N. & Warren, S. (2012). Organic Chemistry (II Edition). Oxford University Press, Oxford.

5. Sanyal, S. N. (2014). Reactions, Rearrangements and Reagents (IV Edition). New Delhi: Bharathi Bhawan (Publishers and Distributors).

6. Smith, M. B. (2015). March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure(VII Edition). New Jersey: John Wiley & Sons, Inc., Hoboken.

6. Warren, S., & Wyatt, P. (2008). Organic Synthesis: The Disconnection Approach (II Edition). John Wiley & Sons Ltd., Chichester.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	**Departmental Elective**	Course **MCH 403 A**	**Environmental Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

To provide an overview of water, air, soil, radioactive and noise pollution including methods for prevention of pollution and its control measures.

Unit I

Environment Introduction. Composition of atmosphere, vertical temperature, temperature inversion, heat budget of the earth, atmospheric system, vertical stability atmosphere, Biochemical cycles of C,N, P, S and O. Biodistribution of elements.

Hydrosphere Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle Aquatic pollution – Inorganic, organic, pesticide, agriculture, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters – dissolved oxygen,biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and microorganisms. Water quality standards.Analytical methods of measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.),residual chloride and chlorine demand. Purification and treatment of water.

UnitII

Soils-Composition, micro and macro nutrients, pollution – fertilizers, pesticides, plastics and metals.Waste treatment.

Atmosphere Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N,

C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Green house effect, acid rain, air pollution controls and their chemistry. Analytical methods for measuring air pollutants. Continuous monitoring instruments.

Unit III

Industrial Pollution

Cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc. Environmental disasters – Cherbonyl, Three mile island, Seveso and Minamata disasters, Japan tsunami.

Unit IV

Environmental Toxicology Toxic heavy metals **:**Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

Toxic Organic Compound **:** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.

Unit-V

Aquatic Chemistry and Water Pollution. Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand Environmental Chemistry and its concepts.
- Build concepts of Hydrosphere, Atmosphere and Soil, their composition, and side effects pollution.
- Understand and apply the concepts industrial pollution and study of some famous environmental disasters.
- Understand and apply the concepts Water pollution, purification and treatment and study of some prime pollutants.
- Develop an understanding of environmental toxicology and some toxic Organic Compounds.

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.
6. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
7. Environmental chemistry, Sharma and Kaur, Krishna Publishers.
8. Environmental Chemistry, Analysis, S.M. Khopkar, Wiley Eastern.
9. Standard Method of Chemical Analysis, F.J.WelcherVol.III, VanNostr and ReinholdCo.
10. Environmental Toxicology, Ed.J.Rose, Gordon and Breach Science Publication. 7. Environmental Chemistry, C. Baird, W.H.Freeman.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	Departmental Elective	Course MCH 403 B	**Chemistry of Materials**	Max: 40	Min: 14

COURSE OBJECTIVE: To bridge the gap between fundamental ideas of chemistry to modern research and industry-related topics.

UNIT I

Ceramics, Composites and Nanomaterials. Ceramic structures, mechanical properties, clay products.Refractories, characterization, properties and applications. Microscopic composites, dispersion-strengthened and particle-reinforced composites, macroscopic composites.Nanocrystalline phase, preparation procedures, properties and applications.

UNITII

Liquid Crystals. Thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases. Molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.

UNIT III

Ionic Conductors. Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel); vacancy mechanism, diffusion superionic conductors, phase transtions and mechanism of conduction in superionic conductors. Examples and applications of ionic conductors.

UNITIV

High TcMaterials. HighTc superconductivity. Preparation and characterization of 1-2-3 and 2-1-4 materials. Normal state properties, anisotropy, temperature dependence of electrical resistance, and optical phonon modes. Superconducting state; heat capacity; coherence length, elastic constants, microwave absorption-pairing and multigap structure in high Tc materials. Applications of high Tc materials.

UNIT V

Organic Solids, Fullerenes, Molecular Devices. Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes, doped, fullerenes as superconductors. Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches, sensors. Non-linear optical materials, non-linear optical effects. Molecular hyperpolarisability.

Course Outcome:

By the end of this course student will be able to-

- Develop an understanding Chemistry of Materials and its application in chemistry.
- Develop an understanding of Ceramics, Composites and Nanomaterials, their structure, characterization, properties and applications.
- Understand and apply the concepts Liquid Crystals and Ionic conductors, their structure, types, properties and applications in wide variety of chemistry, physics and allied fields.
- Build the concept of Superconductors and its indepth study for understanding of their possible applications.
- Build concepts of Organic solids, Fullerenes and Molecular Devices and its applications.

SUGGESTED READING

1. Materials Science and Engineering: An Introduction (Hardcover) by William D. Callister Jr.
2. Introduction to Materials Science for Engineers by James Shackelford
3. Foundations of Materials Science and Engineering by William Smith
4. The Science and Engineering of Materials by Donald Askeland and Wendelin Wright
5. Material Science and Metallurgy by OP Khanna

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	**Open Elective**	Course **MCH 404 A**	Biochemistry	Max: 40	Min: 14

COURSE OBJECTIVE: To provide a comprehensive introduction to biochemistry and to learn the chemistry of enzymes, structures of nucleic acids and biosynthesis of proteins.

UNIT-I

Carbohydrates: Types of naturally occurring sugars: Deoxy-sugars, amino sugars, branched chain sugars. General methods of structure and ring size determination with particular reference to maltose, lactose, sucrose, pectin, starch and cellulose, photosynthesis of carbohydrates, metabolism of glucose, Glycoside- (amygdalin).

UNIT-II

Amino acid, peptides and proteins: General methods of peptide synthesis, sequence determination. Chemistry of insulin and oxytocin.Purines and nucleic acid. Chemistry of uric acid, adenine, protein synthesis.

UNIT-III

Vitamins: A general study, detailed study of chemistry of thiamine (Vitamin B1), Ascorbic acid

(Vitamin C), Pantothenic acid, biotin (Vitamin H), α-tocopherol (Vitamin E), Biological importance of vitamins.

UNIT-IV

Enzymes: Nomenclature and classification, extraction and purification, Remarkable properties of enzymes like catalytic power, specificity and regulation, Proximity effects and molecular adaptation, Chemical and biological catalysis. Mechanism of enzyme action: Transition state theory, orientation and steric effect, acid base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms (chymotrypsin, ribo nuclease, lysozyme and carboxypetidase A). Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors affinity labeling and enzyme modification by site directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

UNIT-V

(A) Kinds of reactions catalyzed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate addition and elimination reactions, enolic intermediates in isomerization reactions, β- cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation reactions.

(B) Coenzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups, and apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate

pyridoxal phosphate, NAD+, NADP+, FMN, FAD, Lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand Biochemistry and its application in chemistry.
- Gain knowledge about concept of Carbohydrates, Amino Acids, Vitamins and enzymes their structure, types, properties, metabolism, synthesis and uses in the human body.

SUGGESTED READINGS

1. Biochemistry, D. Voet and J.G. Voet, John Wiley.
2. Principles of Biochemistry, A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, Delhi.
3. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, John Wiley.

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	**Open Elective**	Course **MCH 404 B**	**Bioorganic Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE

To Understand reactions Catalyzed by Enzymes, chemical strategies and mechanisms behind enzyme catalysis, enzyme models and Biotechnological Application of enzymes.

Unit-I

Introduction :Basic Consideration, Proximity effects and molecular adoption. Enzymes: Introduction, Chemical and Biological catalysis, remarkable properties of enzymes,Nomenclature and classification, concept and identification of active site by use of inhibitors, reversible& irreversible inhibition.

Unit-II

Kinds of Reactions Catalyzed by Enzymes: B-cleavage and consideration, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation. Mechanism of Enzyme action: Transition state theory, Orientation and steric effect, acid-base catalysis, covalent catalysis. Co-Enzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes, Structure and biological functions of coenzyme A.

Unit-III

Enzyme Models :Host guest chemistry, Chiral recognition and catalysis, molecular recognition,

molecular asymmetry and prochirality, Biomimetic chemistry, crown ethers, cryptates, cyclodextrins, cyclodextrin based enzyme models, Calixarenes, ionophores, micelles synthetic

enzyme or synzymes.

Unit-IV

Biotechnological Application of enzymes: Large scale production and purification of enzymes,techniques and methods of immobilization of enzyme activity, application of immobilized enzymes, effect of immobilization on Enzyme activity, application of immobilized enzymes. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Unit-V

Metalloenzymes Copper enzymes, superoxide dismutase, cytochrome oxidase and ceruloplasmin; Coenzymes; Molybdenum enzyme: xanthine oxidase; Zinc enzymes: carbonic anhydrase, carboxy peptidase and interchangeability of zinc and cobalt in enzymes; Vitamin B12 and B12 coenzymes; Iron storage, transport, biomineralization and siderophores, ferritin and transferrins..

Course Outcome:

By the end of this course student will be able to-

- Understand of Bioorganic chemistry and its applications.
- Gain knowledge about Enzymes, their nomenclature, classification, properties,, models and biotechnological and clinical applications.
- Apply knowledge of organic and bioorganic chemistry to predict chemical properties and reactivity in chemical and biological contexts and propose mechanistic hypotheses for reactions.

SUGGESTED READINGS

1. Bioorganic, BioInorganic and Supramolecular Chemistry by P. S. Kalsi and J. P. Kalsi
2. Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding" by A R Fersht and W H Freeman.
3. "Bioorganic Chemistry" by H Dugas.
4. Bioorganic Chemistry: A Chemical Approach to Enzyme Action (Springer Advanced Texts in Chemistry)" by Hermann Dugas

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. I SEM	Practical	**Course MCH 106**	**Inorganic Chemistry**	Max: 50	Min: 18

Qualitative analysis:

1. To identify the given cation, anion and interfering radicals (total six including one interfering radical) from the given inorganic mixture.

Chromatography

1. Separation of cations and anions by Paper Chromatography

2. Separation of cations and anions by Column Chromatography; Ion exchange

Synthesis:

Preparation of selected inorganic compounds and their studies by measurements of decomposition temperature, molar conductance, I.R., electronic spectra, and magnetic susceptibility measurements.

3. $Hg[Co(SCN)_4]$

4. $[Ni(NH3)_6]Cl2$

5. $[Ni(dmg)_2]$

6. $[Cu(NH_3)_4]SO_4 \cdot H_2O$

7.Potassiumtris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$

8.$[Ni(NH_3)_6]Cl_2$

.9.$[Fe_4[Fe(CN)_6]_3$

10. $[Ni\ (acac)_2(H_2O)]$

11. $[Co\ (acac)_2(H_2O)]$

14. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.

Interpretation of IR and Electronic Spectra of some known compounds

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Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. I SEM	Practical	Course MCH 107	**Physical Chemistry**	Max: 50	Min: 18

Maximum Marks: 50 *Minimum Marks: 20*

Adsorption

1. To study surface tension -concentration relationship for solutions (Gibbs equation).

Phase Equilibria

2. To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).*Polarimetry*
3. To calculate specific rotation of sucrose
4. Enzyme kinetics -inversion of sucrose

Chemical Kinetics

5. Determine the rate constant of hydrolysis of an ester as methyl acetate catalysed by an acid Determine also the energy of activation of the reaction
6. Determination of the velocity constant of hydrolysis of an ester and to study the effect of change of concentration on it.

Adsorption

7. To study the adsorption of oxalic acid on charcoal and to prove the validity of Freundlich adsorption isotherm.
8. To study the adsorption of oxalic acid on charcoal and to prove the validity of Langmuir's adsorption isotherm.

Electronics

9.To study the variation of thermo emf with the temperature for the copper-iron thermocouple.
10. To study forward and reverse characteristics of Si and Ge semiconductor diode
11. To observe the wave form of (i) a.c. mains supply and (ii) an oscillator using cathode ray oscilloscope

pH metry

12.To determine the strength of unknown (strong) acid pHmetrically using standard alkali solution(strong).

Conductometry

13. To determine the strength of unknown (strong) acid conductometrically using standard alkali solution(strong).
14. To determine the basicity of an acid.

Potentiometry

15. To determine the strength of unknown (strong) acid potentiometrically using standard alkali solution(strong).

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Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. II SEM	Practical	Course MCH 206	**Organic Chemistry**	Max: 40	Min: 14

Maximum Marks: 50 *Minimum Marks: 20*

Analysis

Separation, purification and identification of compounds of binary mixture (one solid and one liquid/solid) using chemical separation and sublimation/distillation, etc.Their analysis by semi-micro chemical tests and spot tests.IR spectra to be used for functional group identification.Preparation of one derivative of each compound. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.

Organic Synthesis

Aromatic electrophilic substitutions:

1. Synthesis of m-dinitrobenzene from nitrobenzene
2. Synthesis of 2,4-dinitro-1-chlorobenzene from chlorobenzene
3. Synthesis of 4-bromoaniline from acetanilide

Reduction reaction:

Synthesis of m-nitroaniline from m-dinitrobenzene

Oxidation reaction

1. Synthesis of 9,10-anthraquinone by oxidation of anthracene by chromium trioxide
2. Synthesis of 4-nitrobenzaldehyde by oxidation of 4-nitrotoluene by chromium trioxide

Cannizzaro reaction

1. Synthesis of benzyl alcohol from benzaldehyde

Claisen-Schmidt reaction:

2. Synthesis of dibenzylideneacetone (1,5-diphenylpenta-1,4-dien-3-one) from acetone and benzaldehyde

Sandmeyer reaction:

3. Synthesis of 2-chlorobenzoic acid from anthranilic acid

Methylation:

4. Synthesis of methyl 2-naphthyl ether (2-methoxynaphthalene, nerolin) by methylation of 2-naphthol by dimethyl sulphate.

Purification of compounds by TLC and column chromatography

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. II SEM	Practical	Course MCH 207	**Inorganic Chemistry**	Max: 50	Min: 18

Maximum Marks: 50 *Minimum Marks: 20*

Gravimetric Estimation (any two experiments):

Estimte mixture of 2 metal ions(Copper and Zinc)

Sectrophotometric Determination

1. Determination of molecular composition of ferric salicilate /iron-phenanthroline/iron-dipyridyl complex by Job's method of continuous variation
2. Determination of the pH of a given solution by spectrophotometry using methyl red indicator

Synthesis.

1. Aquabis(acetylacetonato)nitrosylchromium(I), $[Cr(NO)(acac)_2(H_2O)]$
2. cis-Bis(glycinato)copper(II) and trans-Bis(glycinato)copper(II)
3. Preparation of Zn, Cd and Hg thiocyanates from their respective chlorides
4. Bis(benzoylacetonato)copper(II)
5. Bis (acetylacetonato)oxovanadium(IV), $[VO(acac)_2]$
6. $[MoO_2(acac)_2]$
7. Hexaammminenickel(II)tetrafluoroborate, $[Ni(NH_3)_6](BF_4)_2$ and determination of nickel content gravimetrically.
8. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.
9. Preparation of N,N-bis(salicylaldehyde)ethylenediamine [salenH_2], Co(salen)

Interpretation of ESR, NMR and Thermogravimetric pre-recorded results of known compounds

Pre-recorded spectrum/data shall be provided for their interpretation leading to structure determination of metal ion complexes with organic ligands

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	***Course Type***	***Course Code***	***Course Title (Theory/Practical)***	***Marks***	
M.Sc. III SEM	Practical	Course MCH 305	**Organic Chemistry**	Max: 50	Min: 18

Maximum Marks: 50 *Minimum Marks: 20*

Analysis

1. Estimation of protein by Lowry's method.
2. Estimation of carbohydrate by Anthrone's method
3. Isolation of caffeine and alkaloids from tea.
4. To determine the iodine value of the given oil or fat
5. To determine the Saponification value of the given oil or fat
6. Estimation of Ascorbic Acid i.e. vitamin C.
7. Estimation of Amino acid by Sorenson's method
8. Spectrophotometric estimation of Glucose with the help of Fehling solution

Multi Step Synthesis

1. Benzoin- benzyl- benzilic acid
2. Benzophenone –benzpinacole- benzpinacolone
3. Ethyl acetoacetate → 3-methyl-1-phenylpyrazol-5-one →antipyrin (phenazone)
4. Benzaldehyde→ benzoin →benzil→ 5,5-diphenylhydantoin
5. Phenylhydrazine→acetophenonephenylhydrazone→ 2-phenylindole
6. Chlorobenzene→ 1-chloro-2,4-dinitrobenzene → 2,4-dinitrophenylhydrazine

Spectral Analysis

Interpretation of pre-recorded UV-Vis, IR, NMR, Mass, Raman spectrum and characterisation of one organic compound

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. III SEM	Practical	Course MCH 306	**Physical Chemistry**	Max: 50	Min: 18

Maximum Marks: 50 *Minimum Marks: 20*

Conductometry

1. To determine the strength of unknown (given weak) acid conductometrically using standard alkali solution(strong).
2. To determine the strength of unknown (given strong) acid conductometrically using standard alkali solution(weak).
3. To determine the strength of acid conductometrically using standard alkali solution in a mixture of acids
4. To determine the dissociation constant of weak electrolyte and to verify Ostwald's dilution law.
5. To determine the equivalent conductance of strong electrolyte at the several concentration and hence verify Onsagar equation.
6. To find the solubility and solubility product of sparingly soluble salt conductometrically.

pH metry

7. To determine the strength of unknown (given weak) acid pHmetrically using standard alkali solution(strong).
8. To determine the strength of unknown (given strong) acid pHmetrically using standard alkali solution(weak).
9. To determine the strength of acid pHmetrically using standard alkali solution in a mixture of acids

Potentiometry

10. To determine the strength of unknown (given weak) acid potentiometrically using standard alkali solution (strong).
11. To determine the strength of unknown (given strong) acid potentiometrically using standard alkali solution (weak).
12. To determine the strength of acid potentiometrically using standard alkali solution in a mixture of acids

Spectrophotometery

13. To verify Lambert-Beer's law using a spectrophotometer.

Enzyme Kinetics

14. To study the effect of temperature on invertase enzyme activity and determine its optimum pH
15. To study of the effect of substrate concentration on enzyme activity.
16. Effect of enzyme concentration on enzyme activity.

SYLLABUS

PG

BIOTECHNOLOGY

AS PER THE UGC GUIDELINES FOR THE CHOICE BASED CREDIT SYSTEM

St. Aloysius' College (Autonomous), Jabalpur

DEPARTMENT OF BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

2023-24

Distribution of credits

M. Sc. Biotechnology

S. No.	Type of Subject/Activity	Number of Paper	Credit Per Paper/Practical	Total Credit
1.	Core	11	04	44
2.	Electives	02	02	04
3.	Practical	03	08	24
5.	Soft skills	02	02	04
6.	Dissertation and Comprehensive Viva	01	24	24
				100 Credits

Distribution of Marks and Credits

Course Code	Paper title	End Semester Exam	CIA	Credits
Semester First				
BT 101	Cell & Developmental Biology (Core)	40	20	4 Credits
BT 102	Biomolecules (Core)	40	20	4 Credits
BT 103	Molecular Biology (Core)	40	20	4 Credits
BT 104	Analytical Techniques (Core)	40	20	4 Credits
BT 105	Practical	100		8 Credits
Semester Second				
BT 201	Immunology (Core)	40	20	4 Credits
BT 202	Microbiology and Industrial Applications (Core)	40	20	4 Credits
BT 203	Genetic Engineering (Core)	40	20	4 Credits
BT 204	Biostatistics and Bioinfomatics (Core)	40	20	4 Credits
BT 205	Environment and Elementary Ecology (Elective)#	100		2 Credits
BT 206	Basics of Management (Elective)#	40	20	2 credits
BT 207	Soft Skills	50		2 Credits
BT 208	Practical	100		8 Credits
Semester Third				
BT 301	Bioprocess Engineering & Environmental Biotechnology (Core)	40	20	4 Credits
BT 302	Plant Biotechnology (Core)	40	20	4 Credits
BT 303	Animal Biotechnology (Core)	40	20	4 Credits
BT 304	Medical Biotechnology(Elective)#	40	20	2 Credits
BT 305	Applied Oncology (Elective)#	40	20	2 Credits
BT 306	Research Methodology	100		2 Credits
BT 307	Soft Skills	50		2 Credits
BT 308	Practical	100		8 Credits
Semester Four				
BT 301	Dissertation	200		24 Credits
BT 302	Comprehensive viva-voce	50		
BT 303	Seminar	50		
#any 1 out of 2 electives should be chosen by the students				
Grand Total (All Semesters) = 2000		**Total no. of Credits (All Semesters) = 100**		

M.Sc. Biotechnology Syllabus
SEMESTER – I

Course Code	Title	Credits
BT 101	Cell & Developmental Biology **(Core)**	**04**
BT 102	Biomolecules **(Core)**	**04**
BT 103	Molecular Biology **(Core)**	**04**
BT 104	Analytical Techniques **(Core)**	**04**
BT 105	Practical	**08**
	TOTAL	**24 Credits**

SEMESTER – II

Course Code	Title	Credits
BT 201	Immunology **(Core)**	**04**
BT 202	Microbiology and Industrial Applications **(Core)**	**04**
BT 203	Genetic Engineering **(Core)**	**04**
BT 204	Biostatistics and Bioinfomatics **(Core)**	**04**
BT 205	Environment and Elementary Ecology (Elective)[#]	**02**
BT 206	Basics of Management (Elective**)** [#]	**02**
BT 207	Soft Skills	**02**
BT 208	Practical	**08**
	TOTAL	**28 Credits**

SEMESTER – III

Course Code	Title	Credits
BT 301	Bioprocess Engineering & Environmental Biotechnology **(Core)**	**04**
BT 302	Plant Biotechnology **(Core)**	**04**
BT 303	Animal Biotechnology **(Core)**	**04**
BT 304	Medical Biotechnology**(Elective)**[#]	**02**
BT 305	Applied Oncology **(Elective)**[#]	**02**
BT 306	Research Methodology **(Elective)** [#]	**02**
BT 306	Soft Skills	**02**
BT 307	Practical	**08**
	TOTAL	**24 Credits**

[#]any 1 out of 3 electives should be chosen by the students

SEMESTER – IV

Course Code	Title	Credits
BT 301	Dissertation	**24**
BT 302	Comprehensive viva-voce	
BT 303	Seminar	
	TOTAL	**24 Credits**

Total Credits…….....100 Credits

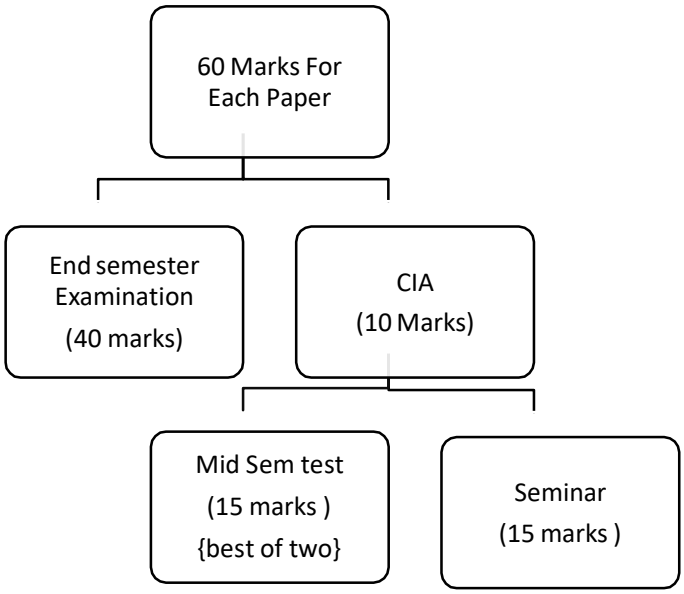
DISTRIBUTION OF MARKS

(i) The scheme of assessment during the semester (30 marks):

(a) The assessment (sessional) in theory courses shall comprise a class test of 1 hour duration for 15 marks and 15 marks will be awarded for the seminar/ paper presentation/tutorial.

(b) The class tests shall be conducted by the teacher (or group of teachers) teaching the course and the marks shall be displayed on the Notice Board. The evaluated test copies will be shown to the students. The tests will be conducted in the middle of each semester.

(ii) End Semester Examination and evaluation (30 marks):



Mode of CIA – Test, Seminars, Environmental and Immunological Survey etc.,

First Semester

Course Code	Title	Credits	Theory	CIA
BT 101	Cell & Developmental Biology **(Core)**	04	70 marks	30marks
BT 102	Biomolecules **(Core)**	04	70 marks	30marks
BT 103	Molecular Biology **(Core)**	04	70 marks	30marks
BT 104	Analytical Techniques **(Core)**	04	70 marks	30marks
BT 106	Practical	08	100 marks	-
	TOTAL	**24 credits**	**500 marks**	

Paper I

Cell & Developmental Biology

Unit 1

Principles of Microscopy: Optical (including Phase contrast and Differential interference);Fluorescence, Confocal and Electron Microscopy.

Structure of Cell (Bacterial, Plant and Animal): Cell membranes, Composition & architecture of Cell Wall.

Unit 2

Structure and function of organelles (mitochondria, chloroplast, Nucleus, Golgi apparatus, Lysosomes,Ribosomes) and Cytoskeletal elements.

Cell adhesion; cell junctions, cell adhesion molecules & extra-cellular matrix.

Unit 3

Transport across biomembranes: facilitated transport, group translocation, Active transport, Na+-K+ ATPase pump.

Basic concepts of signal transduction.

Cell cycle and its control.

Unit 4

Developmental biology- developmental stages in frog.

Spatial and temporal gene expression and developmental stages in drosophila and Arabidopsis.

Organization of Root Apical Meristem (RAM); Pollen germination and pollen tube guidance; Self-incompatibility and its genetic control.

Unit 5

Brief introduction to the biology of following pathogens: AIDS, Malaria, Tuberculosis ,Hepatitis, Filaria and Kalazar.

Paper II
Biomolecules

Unit - I

Chemical basis of life:

Types of chemical bonds- electrostatic, covalent, van der walls' interactions, hydrogen bonding,

Composition of living matter; Water – properties, pH and buffers,

Nucleic acids- their basic structures and various forms of DNA (A,B,Z). Supercoiling

Unit 2

Proteins:

Primary, secondary, tertiary and quaternary structure of protein; RamachandranPlot , Protein folding; Structure-function relationships in model proteins like ribonuclease A, myoglobin, hemoglobin, chymotrypsin. Protein- protein interaction

Unit - III

Enzyme catalysis:

Classification and nomenclature of enzymes, Steady state kinetics: Methods for estimation of rate of enzyme catalyzed reaction with specialreference to Michaelis-Menten equation. Effects of substrate, temperature, pH and inhibitors on enzyme activity and stability.

Mechanism of enzyme action (active site, chemical modification) and regulation(Zymogens,Isozymes), Applications of enzymes, Immobilization of Enzymes, Coenzymes and Cofactors.

Unit - IV

Sugars and lipids (Carbohydrates):

An overview of structure & function of Carbohydrate and Lipids and properties of important members of storage and membrane lipids; lipoproteins, β-oxidation of fatty acids.

Unit V

Basic principles; Equilibria and concept of free energy; Coupled processes; Glycolytic pathway; Kreb's cycle; Oxidative phosphorylation; Photosynthesis; Elucidation of metabolic pathways; Logic and integration of central metabolism; entry/ exit of various biomolecules from central pathways; Regulatory steps.

Paper III
Molecular Biology

Unit I
Genome organization
Organization of bacterial genome; Structure of eukaryotic chromosomes; Heterochromatin and Euchromatin; DNA re-association kinetics (Cot curve analysis); Repetitive and unique sequences; Satellite DNA; DNA melting and buoyant density; Nucleosome phasing; DNase I hypersensitive regions; DNA methylation & Imprinting.

Unit II
DNA Structure; Replication; Repair & Recombination
Replication initiation, elongation and termination in prokaryotes and eukaryotes; Enzymes and accessory proteins; Fidelity; Replication of single strandedcircular DNA; Gene stability.
DNA repair- enzymes; Photoreactivation; Excision repair; Mismatch correction; SOS repair;
Recombination: Homologous and non-homologous; Site specific recombination.

Unit III
Prokaryotic & Eukaryotic Transcription
Prokaryotic Transcription; Transcription unit; Promoters- Constitutive and Inducible; Operators; Regulatory elements; Initiation; Attenuation; Termination-Rho-dependent and independent; Anti-termination; Transcriptional regulation-Positive and negative; Operon concept-lac, trp, operons; Transcriptional control in lambda phage; Transcript processing; Processing of tRNA and rRNA Eukaryotic transcription and regulation; RNA polymerase structure and assembly; RNA polymerase I, II, III; Eukaryotic promoters and enhancers; General Transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF); Transcriptional and post-transcriptional gene silencing

Unit IV
Post Transcriptional Modifications
Processing of hnRNA, tRNA, rRNA; 5'-Cap formation; 3'-end processing and polyadenylation; Splicing; RNA editing; Nuclear export of mRNA; mRNA stability; Catalytic RNA.
Translation & Transport
Translation machinery; Ribosomes; Composition and assembly; Universal genetic code;
Degeneracy of codons; Termination codons; Wobble hypothesis; Mechanism of initiation, elongation and termination; Co- and post-translational modifications.

Unit V
Mutations; Oncogenes and Tumor suppressor genes
Physical, chemical and biological mutagens; Nonsense, missense and point mutations; Intragenic and Intergenic suppression; Frame shift mutations; Physical, chemical and biological mutagens; Transposition - Transposable genetic elements in prokaryotes and eukaryotes; Mechanisms of transposition; Role of transposons in mutation; Viral and cellular oncogenes; Tumor suppressor genes from humans; Structure, function and mechanism of action of pRB and p53 tumor suppressor proteins; Activation of oncogenes and dominant negative effect; Suppression of tumor suppressor genes; Oncogenes as transcriptional activators.

Paper IV
Analytical techniques

Unit I

Spectroscopy Techniques

UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, NMR, PMR, ESR and Plasma Emission spectroscopy

Unit II

Chromatography Techniques

TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC.

Electrophoretic techniques

Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis, PAGE and SDS-PAGE

Unit III

Centrifugation

Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc); Types of centrifuge -Micro centrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods.

Unit IV

Radioactivity

Radioactive & stable isotopes; Pattern and rate of radioactive decay; Units of radioactivity; Measurement of radioactivity; Geiger-Muller counter; Solid & Liquid scintillation counters (Basic principle, instrumentation & technique; Autoradiography; Measurement of stable isotopes; Falling drop method; Applications of isotopes in biochemistry; Radiotracer techniques; Distribution studies; Isotope dilution technique; Metabolic studies; Clinical application; Radioimmunoassay

Unit V

Advanced Techniques

Protein crystallization; Theory and methods; API-electrospray and MALDI-TOF; Mass spectrometry; Enzyme and cell immobilization techniques; DNA & Peptide Synthesis.

PRACTICALS

Paper 1- Cell and Developmental Biology

1. Study of mitosis and Meiosis from/plant material
2. Principle and practice of microscopy: bright field, phase contrast and fluorescence
3. Microscopic examination of malarial parasite and tuberculosis in permanent slides
4. Microscopic examination of sperms

Paper 2- Biomolecules

1. Titration of amino acids and calculation of pK value.
2. To determine unknown protein concentration by spectrophotometric method.
3. Enzyme Kinetics of alkaline phosphatase from goat liver.
4. Quantitative estimation of DNA by spectrophotometric method.
5. Quantitative estimation of RNA by colorimetric method.

Paper 3- Molecular Biology

1. Isolation of plant genomic DNA from leaves
2. Isolation of bacterial genomic DNA
3. Plasmid DNA isolation.
4. Restriction digestion of bacterial DNA.
5. Bacterial conjugation.

Paper 4- Analytical Techniques

1. Gel filtration chromatography for separation of macromolecules.
2. Native PAGE of given protein sample
3. Agarose gel electrophoresis of given DNA sample
4. Thin layer chromatography of given sample

SEMESTER II

Course Code	Title	Credits	Theory	CIA
BT 201	Immunology **(Core)**	04	70 marks	30 marks
BT 202	Microbiology and Industrial Applications **(Core)**	04	70 marks	30 marks
BT 203	Genetic Engineering **(Core)**	04	70 marks	30 marks
BT 204	Biostatistics and Bioinfomatics **(Core)**	04	70 marks	30 marks
BT 205	Environment and Elementary Ecology **(Elective)**[#]	02	100 marks	-
BT 105	Basics of Management **(Elective)** [#]	02	100marks	-
BT 207	Soft Skills	02	50 marks	-
BT 208	Practical	08	100 marks	-
	TOTAL	**28**	**650 marks**	

Paper V
Immunology

Unit I

Immunology- fundamental concepts and anatomy of the immune system

Components of innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoesis; Organs and cells of the immune system- primary and secondary lymphoid organs; Lymphatic system; lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous associated Lymphoid tissue.(MALT&CALT); Mucosal Immunity; Antigens - immunogens, haptens- Hapten-carrier system; Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing.

Unit II

Immune responses generated by B and T lymphocytes

Immunoglobulins-basic structure, classes & subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily;Basis of self –non-self discrimination; Kinetics of immune response, memory; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC; Cytokines-properties, receptors and therapeutic uses; Antigen processing and presentation- endogenous antigens, exogenous antigens; non-peptide bacterial antigens and super antigens.

Unit III

Antigen-antibody interactions

Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, immunofluorescence, flow cytometry and immunoelectron microscopy; Surface plasmon resonance, Biosensor assays for assessing ligand –receptor interaction, lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays,

Unit IV

Vaccinology

Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines; chimeric and hybrid monoclonal antibodies;

Unit V

Clinical Immunology

Immunity to Infection: Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity – Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy;

Paper VI
Microbiology

UNIT-I

The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields; synchronous growth; growth as affected by environmental factors like temperature, acidity, water availability and oxygen; cult ure collection and maintenance of cultures, continuous culture.

UNIT-II

Metabolic diversity among microorganisms, photosynthesis in microorganisms; role of chlorophylls, carotenoids and phycobilins: Calvin cycle; chemolithotrophy; hydrogen-ironnitrite oxidizing bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis; fermentations-diversity, syntrophy, role of anoxic decompositions; nitrogen fixation; hydrocarbon transformation.

UNIT-III

Structural diversity of bacteria: purple and green bacteria, cyanobacteria, homoacotogenic bacteria, acetic acid bacteria, budding and appendaged bacteria, spirilla, spriochaetes, gliding and sheathed bacteria, pseudomonads, lactic and propionic acid bacteria, endospore forming rods and cocci, mycobacteria, rickettsias, chlamydias and mycoplasms, methanogens;
Structural diversity of viruses: bacterial, plant, animal and tumor viruses examples of herpes, pox, adenoviruses, retroviruses, viroids and prions.

UNIT-IV

Host-parasite relationship: entry of pathogens into the host; colonization types of toxins: exo-endo-and entero-toxins and their structures, mode of action, Chemotherapy/antibiotics: antimicrobial agents, sulfa drugs, antibiotics, penicillins and cephalosporins, broad spectrum antibiotics, mode of action, resistance to antibiotics.

UNIT-V

Genes, mutation and mutagenesis; UV and chemical mutagens; types of mutation; Ames test for mutagenesis, methods of genetic analysis. Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids and transposons in bacteria ; bacterial genetics map with reference to E. coli.

Paper- VII
Biostatistics & bioinformatics

Unit- I

Introduction: Definition, scope and limitations of biostatistics; collection, classification, tabulation, graphical and diagrammatic representation of data; measure of central tendency: mean (arithmetic, harmonic & geometric), median and mode; confidence limit of the population mean.

Unit-II

Measure of dispersion: Range, standard deviation, variance, coefficient of variation; definition and basic properties of probability, normal and binomial probability distribution functions, test of significance, hypothesis, error, level of significance; t-statistics, paired 't' test.

Unit –III

F- statistics: one way analysis of variance (sample size equal and unequal), Chi square statistics: test of goodness of fit, test of independence of factors; co-relation and its coefficient; linear regression and its coefficient, regression equation and its diagrams.

Unit-IV

Overview and functions of a computer system, introduction to Database concept, introduction to internet concept and its applications, Introduction to MS Office

Types of modern computers: The work station, the minicomputer, mainframe computers, parallel processing computer, the super computer etc.

Unit-V

Introduction to bioinformatics, searching databases and locating genes, phylogenetic analysis- introduction,

Pair Wise Sequence Alignment of gene sequences- local and global, BLAST and its variants; FASTA,Computer aided drug designing- concepts, methods and practical approaches and various computational methods.

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Paper- VIII
Genetic Engineering

Unit-I

Scope of genetic engineering, milestones in genetic engineering; chemical synthesis of DNA, cloning and patenting of life forms; genetic engineering guidelines; molecular tools and their applications; restriction enzymes, modification enzymes, DNA and RNA markers; nucleic acid purification, yield analysis.

Unit-II

Nucleic acid amplification and its types- RT-PCR, Nested-PCR, Anchored -PCR , gene cloning vectors-plasmids, bacteriophages, phagemids, cosmids, artificial chromosomes; restriction mapping of DNA fragments and map construction; nucleic acid sequencing; cDNA synthesis and cloning; reverse transcription, DNA primers, linkers, adaptors, library construction and screening.

Unit-III

Alternative strategies of gene cloning; cloning interacting genes-two-and three hybrid systems, cloning differentially expressed genes, nucleic acid micro array; site-directed mutagenesis and protein engineering; gene regulation-DNA transfection, Northern blot, primer extension, S1 mapping, RNase protection assay, reporter assays.

Unit-IV

Expression strategies for heterologous genes; vector engineering and codon optimization, host engineering; in vitro transcription and translation, expression in bacteria, yeast, insects and insect cells, mammalian cells, plants; processing of recombinant proteins-purification and refolding, characterization of recombinant proteins, stabilization of proteins; phage display.

Unit-V

Transposons in maize; T-DNA and transposon tagging; transgenic technology in plants and animals and strategies for gene delivery, gene knockout technologies , targeted gene replacement, chromosome engineering; gene therapy ; gene replacement/augmentation, gene silencing; siRNA Technology.

PRACTICALS

Paper 5- Immunology

1. Blood film preparation and identification of cells.
2. Lymphoid organs and their microscopic organization.
3. Double diffusion assay.
4. Immuno-electrophoresis
5. Radial Immuno diffusion.
6. Dot ELISA.
7. Blood smear identification of leucocytes by Giemsa stain.
8. Separation of leucocytes by dextran method.
9. Separation of mononuclear cells by Ficoll-Hypaque.

Paper 6- Microbiology and Industrial Applications

1. Identification and culturing of various microorganisms.
2. Growth curve; measurement of bacterial population by turbidometry and serial dilution methods; effects of temperature, pH, carbon and nitrogen sources on growth.
3. Assay of antibiotics and demonstration of antibiotic resistance.
4. Determination of thermal death point and thermal death time of microorganisms.

Paper 7- Genetic Engineering

1. Isolation of genomic DNA from Bacteria.
2. PCR amplification
3. Isolation of plasmid DNA.
4. Restriction digestion of bacterial DNA.

Paper 8- Biostatistics and Bioinfomatics

1. Computation of various measures of dispersion by using Excel.
2. Student's 't' test, 'F' and ' chi' square test.
3. Pubmed.
4. BLAST.
5. Database- NCBI.

Elective Course - I
Environment and Elementary Ecology

Unit I

Major biomes of the world, tropical rain and seasonal forests, temperate rain and seasonal forests, boreal forests, grasslands, deserts, aquatic ecosystems wetlands, lakes and pond streams and rivers, marine and estuarine habitats.

Unit II

Resource utilization, status and utilization of biodiversity, sustainable development resources from forest, grassland and aquatic habitats. Food forage, fodder, timber and non-wood forest products. Threats to quality and quantity of resources due to overexploitation.

Unit III

Strategies for conservation of resources: classifications of resources. Principles of conservation, *In-situ* conservation sanctuaries , national parks, biosphere reserves for wildlife conservation, habitat conservation practices of conservation for forests range. Soil and water.

Unit IV

Introduction to Ecology: Definition & Scope; Environment: Physical environment, biotic environment, biotic and abiotic interaction.

Population Ecology: Characterstics of a population, population growth curves, population regulation, concept of meta-population.

Unit V

Ecological succession: types, mechanism, models of succession.

Community organization: Types of species interaction, food chain, food web, ecological pyramids, energy flow.

Elective Course -II
Basics of Management

Unit-I

Management Concepts: meaning, thoughts, scope and importance of management, Concept of functions of management, Concept of organization, Delegation, Types of organization and organization charts.

Unit-II

Basic HD concept. Business communication, practical application: letters, memoranda, reports, summaries and notes, group communication, meetings, advertising and public relation.

Unit-III

Financial management: concept of money, accounting, double entry system, vouchers, journals, ledgers, profit and loss account, balance sheet, costing: direct and indirect cost, marginal cost, breakeven point, budgetary control, zero based budgeting..

Unit-IV

Marketing Concept: different between sales and marketing, customer satisfaction, customer retention, CRM, market mix, product mix, product life cycle, distribution.

Unit-V

Organization behavior: motivation techniques, leadership skills, decision making skills, interpersonal skills, negotiation, conflict resolution, individual behavior and group behaviour.

Semester 3

Course Code	Title	Credits	Theory	CIA
BT 301	Bioprocess Engineering & Environmental Biotechnology **(Core)**	04	40 marks	10 marks
BT 303	Plant Biotechnology **(Core)**	04	40 marks	10 marks
BT 304	Animal Biotechnology **(Core)**	04	40 marks	10 marks
BT 305	Medical Biotechnology**(Elective)**#	02	40 marks	10 marks
BT 306	Applied Oncology **(Elective)**#	02	40 marks	10 marks
BT 307	Research Methodology **(Elective)**#	02	40 marks	10 marks
BT 307	Soft Skills	02	50 marks	-
BT 308	Practical	08	100 marks	-
	TOTAL	**24**	**550 marks**	

Paper-9
Bioprocess Engineering & Environmental Biotechnology

Unit-I

Basic principle of Biochemical engineering

Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics Strain improvement for increased yield

Concepts of basic mode of fermentation processes

Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; biotransformation; Solid substrate, surface and submerged fermentation; Fermentation media; Fermenter design – mechanically agitated; Large scale animal and plant cell cultivation and air sterilization; Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.

Unit-II

Downstream processing

Bioseparation - filtration, centrifugation, sedimentation, flocculation; Cell disruption; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.

Unit-III

Industrial production: Ethyl alcohol, citric and acetic acids; enzymes; amylases, proteases, cellulases; vitamins: vitamin B12, vitamin C, antibiotics (penicillin, streptomycin, tetracycline). Microbes in petroleum industry (oil recovery); whole cell immobilization and their industrial application.

Introduction to Food Technology

Elementary Idea of canning and packing.Dairy Microbiology: Source & types of Micro-organisms, microbial examination of milk, pasteurization & Phophatase test, sterilization of milk, grades of milk, Dairy products- butter & cheese.

Unit-IV

Environment: Basic concepts and issues; environmental pollution; measurement of soil pollution (pesticides and fertilizers) ; air sampling techniques

Microbial degradation and bioremediation of xenobiotics in the environment, decay behaviour & degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides;bioremediation of contaminated soils, bioaccumulation of metals and their detoxification;

Unit-V

Biological N2 fixation, H2 production, biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production). Single cell protein (Spirulina, yeast, mushroom); global environmental problems-ozone depletion, UV-B , green house effect and acid rain, their impact, biotechnological approaches for their management.

Paper -10
Plant Biotechnology

Unit-I

Plant Tissue Culture

Historical perspective; Totipotency; Organogenesis; Somatic embryogenesis; Regulation and applications; Artificial seed production; Micropropagation; Somaclonal variation; Androgenesis and its applications in genetics and plant breeding; Germplasm conservation and cryopreservation.

Protoplast Culture and Somatic Hybridization

Protoplast isolation; Culture and usage; Somatic hybridization – methods and applications; Cybrids and somatic cell genetics.

Unit-II

Agrobiology

Agrobacterium-plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T-DNA transfer; Disarming the Ti plasmid.

Genetic Transformation

Agrobacterium-mediated gene delivery; Co integrate and binary vectors and their utility; Direct gene transfer-PEG-mediated, electroporation, particle bombardment and alternative methods; Screen able and selectable markers; Characterization of transgenics; Chloroplast transformation; Marker-free methodologies; Gene targeting.

Unit-III

Molecular Mapping & Marker Assisted Selection (MAS)

Quantitative and qualitative traits; MAS for genes of agronomic importance, e.g. insert resistance, grain quality and grain yield; Molecular polymorphism, Dominant & Co-dominant markers; Construction of genetic and physical map; Gene QTL mapping and cloning;

Strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance

Bacterial resistance; Viral resistance; Fungal resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity, thermal stress, flooding and submergence tolerance.

Unit-IV

Genetic Engineering for Plant Architecture and Metabolism

Seed storage proteins; Proteins engineering; Vitamins and other value addition compounds; Source-sink relationships for yield increase;

Fermentation and production of industrial enzymes, vitamins and antibiotics and other biomolecules; Cell cultures for secondary metabolite production; Production of pharmaceutically important compounds; Bioenergy generation.

Unit-V

Chloroplast transformation: advantages, vectors, success with tobacco and potato; metabolic engineering and industrial products; phenyl propanoid pathway, Shikimate pathway:- alkaloids, industrial enzymes; biodegradable plasticsPolyhydroxybutyrate; therapeutic proteins; lysosomal enzymes, antibodies, edible vaccines purification strategies.

Patent & Agencies for patenting PBR & Farmers right and release of new variety.

Paper-11
Animal Biotechnology

Unit-I

Structure and organization of animal cell; equipments and materials for animal cell culture technology; primary and established cell lines cultures; introduction to the balanced salt solutions and simple growth medium; brief account of chemical, physical and metabolic functions of different constituents of culture medium; role of carbon dioxide, serum and supplements.

Unit- II

Serum and protein free defined media and their application, measurement of viability and cytotoxicity; biology and characterization of the cultured cells, measuring parameters of growth; basic techniques of mammalian cell culture in vitro; disaggregation of tissue and primary culture; maintenance of cell culture; cell separation.

Unit- III

Scaling up of animal cell culture, cell synchronization, cell cloning and micromanipulation, cell transformation.

Unit- IV

Embryonic stem cells and their culture, stem cell cultures (epithelial cell culture), Application of animal cell cultures, cell culture based vaccines, somatic cell genetics. Introduction of assisted reproductive technologies for genetic improvement of farm animals.

Unit- V

Organ and histotypic culture, measurement of cell death, apoptosis, three dimensional culture and tissue engineering. Culture collection centers for animal cell lines.

PRATICALS

Paper 9 Bioprocess Engineering & Environmental Biotechnology

1. Sauer Kraut fermentation
2. Use of alginate for cell immobilization.
3. Fermentation of ethanol
4. Detection of coliforms for determination of the purity of potable water.
5. Determination of dissolved oxygen concentration of water sample.
6. Determination of biological oxygen demand (BOD) of a sewage sample.
7. To study the impact of heavy metals on growth & survival of microbes.
8. To study the impact of salt and osmotic stress on the growth survival of microbes.

Paper 10 Plant Biotechnology

1. Preparation of media for plant culture.
2. Surface sterilization.
3. Embryo culture.
4. Callus propagation.
5. Protoplast isolation.

Paper 11 Animal Biotechnology

9. Preparation of single cell suspension from spleen and thymus.
10. Cell counting and cell viability.
11. Macrophage monolayer from PEC, and measurement of phagocytic activity.
12. Trypsinization of monolayer and sub-culturing.
13. MTT assay for cell viability and growth.

Elective Course – II
Medical Biotechnology

Unit-I

Classification of genetic diseases. Chromosomal disorders – Numerical disorders e.g. trisomies & monosomies, Structural disorders e.g. deletions, duplications, translocations & inversions, Chromosomal instability syndromes. Gene controlled diseases – Autosomal and X-linked disorders, Mitochondrial disorders.

Unit-II

Molecular basis of human diseases - Pathogenic mutations. Gain of function mutations: Oncogenes, Huntingtons Disease, Pittsburg variant of alpha 1 antitrypsin. Loss of function - Tumour Suppressor. Genomic. Dynamic Mutations - Fragile- X syndrome, Myotonic dystrophy. Mitochondrial diseases

Unit -III

Prenatal diagnosis - Invasive techniques - Amniocentesis, Fetoscopy, Chorionic Villi Sampling (CVS), Microarray technology- genomic and c DNA arrays, application to diseases.

Unit –IV

Gene blocking therapies Gene Knockouts, Gene disruption-p53, prion diseases, immunological, short RNA, Gene therapy for non-inheritable diseases, stem cell therapy, somatic cell gene therapy and germ line gene therapy

Unit -V

Vectors used in gene therapy Biological vectors – retrovirus, adenoviruses, Herpes Synthetic vectors– liposomes, receptor mediated gene transfer.

Elective Course – II
Applied Oncology

Unit-I
Introduction:
Biology of cancer cells, Types and general characteristics of tumors; Chromosomal aberrations in neoplasia; check points in Cell cycle.

Unit-II
Cell Transformation and Tumorigenesis:
Somatic mutation and cancer cells, Oncogenes; Tumour Suppressor genes, telomerase activity

Unit-III
Familial Cancers:
Definition and types of familial cancer, Characteristics and signs of familial cancer Retinoblastoma, colorectal cancer, breast cancer

Unit IV
Tumour progression:
Tumour initiation and tumour promoter, Genetic and epigenetic changes, angiogenesis and metastasis; Tumour specific markers, tumour micro environment and cancer development.

Unit V
Treatment of Cancer: Chemotherapy, Radiation therapy, immunotherapy, targeted therapy and stem cells in cancer therapy. Cancer risk assessment and counseling.

Elective Course – II
Research Methodology

UNIT 1:

Fundamentals of Research: What is research? Purpose of research, Classification of research, Fundamentals of research methods, Writing a research proposal, Problem Identification, Identification of variables, Citation and Citation indexing.

UNIT 2:

Research Design: Selecting a study design: Differences between quantitative and qualitative study designs, Study designs in quantitative research, Data collection: Selecting a method of data collection, Differences in the methods of data collection in quantitative and qualitative research, Collecting data using attitudinal scales.

UNIT 3:

Ethics and Plagiarism:

Ethics: concept, ethical principles in research, importance of ethics in research, Plagiarism: Concept, Types, Importance, means to avoid Plagiarism and Plagiarism Checkers.

UNIT 4:

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

UNIT 5:

Application of Software: Latex (Writing Paper, Thesis, Report, and Bibliography), SPSS.

CBCS SYLLABUS HAS BEEN RECOMMENDED BY THE EXPERTS AND ALL THE MEMBERS OF THE BOS FOR M.SC BIOTECHNOLOGY SUBJECT TO APPROVAL OF RELEVANT STATUTORY BODY.

SYLLABUS

PG

ZOOLOGY

St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - I Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2023-24)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min. Marks For Passing
CORE COURSES				
ZC -101	Biosystematics, Taxonomy and Evolution	4	40	14
ZC -102	Structure and function of Invertebrates	4	40	14
ZC -103	Quantitative Biology, Biodiversity and Wild Life	4	40	14
ZC -104	Biomolecules and structural Biology	4	40	14
ELECTIVE COURSE – (Any 01)				
ZE -105	• Wild life conservation • Entomology	4	40	14
INTERNAL ASSESSMENT				
ZI - 106	CCE-Written test (Based on core and elective courses ZC - 101, 102 ,103,104 & ZE-105) (Each test of 10 marks)	0	50	20 (04 in each Test)
ZI - 107	Project / Seminar	1	25	09
PRACTICALS				
ZP - 108	Practical- I Based on Courses ZC -101. & ZC -102.	2	50	18
ZP - 109	Practical- II Based on Courses ZC -103, ZC -104 & ZE -105.	2	50	18
SKILL BASED COURSE				
ZS-110	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**385**	**139**

M.Sc. Zoology I Semester

Session 2023-24

CORE COURSE

Paper-1

Biosystematics, Taxonomy and Evolution

MM: 40

Unit I - Definition and basic concepts of biosystematics taxonomy and classification.

- History of classification.
- Theories of classification, hierarchy of categories.
- Trends in biosystematics: Chemotaxonomy, Cytotaxonomy and Molecular Taxonomy
- Taxonomic categories wsr Species ,Genus , Order ,Class and Phyla category
- Subspecies and other infra- specific categories.
- Species concepts: different species concepts.
- Types of speciation: Allopatric, Sympatric, Parapatric and Peripatric
- Origin, patterns and mechanism of reproductive isolation.

Unit II- Taxonomic procedures

- Taxonomic Characters.
- Taxonomic collections, preservation, curating, process of identification.
- Taxonomic keys: different types of keys, their merits and demerits.
- Rules of International code of Zoological Nomenclature (ICZN):

Unit III - Evaluation of biodiversity indices

- Evaluation of Shannon-Weiner Index.
- Evaluation of Dominance Index.
- Similarity and Dissimilarity Index.
- Elementary idea of Metapopulations

Unit IV – Population Genetics and Evolution -

- Concepts of evolution and theories of organic evolution with an emphasis on Lamarckism, Darwinism, Neo Darwinism and modern synthetic theory
- Population genetics:
  - Hardy-Weinberg law of genetic equilibrium.
  - A detailed account of Natural selection as a destabilizing force in Hardy-Weinberg law of equilibrium.
  - Mutation as a destabilizing force in Hardy-Weinberg law of equilibrium.
  - Genetic Drift as a destabilizing force in Hardy-Weinberg law of equilibrium.
  - Migration as a destabilizing force in Hardy-Weinberg law of equilibrium.
  - Meiotic Drive.

- Molecular Evolution
  - Gene evolution (molecular clock)
  - Evolution of gene families (beta globin clusters)

Unit V - Origin and Evolution -

- Origin of Higher categories-
  - Phylogenetic gradualism and punctuated equilibrium.
  - Major trends in the origin of higher categories
  - Micro and macroevolution.
- Molecular Phylogenetics -

a) Phylogenetic tree
b) Pattern of changes in nucleotide and amino acid sequence.
c) Ecological significance of molecular variations (genetic polymorphism)

- Biological mechanism of genetic incompatibility
- Origin and Evolution of economically important animal - Horse.

Suggested Reading Materials:

1. M. Koto-The Biology of biodiversity-Springer
2. E.O.Wilson-Biodiversity-Academic Press Washington.
3. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication Company.
4. E-Mayer-Elements of Taxonomy
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.
6. Skoal R. R. and F.J. Rohiff Biometry-Freeman, San-Francisco.
7. Snecdor, G.W. and W.G. Cocharan Statisical Methods of affiliated –East–West Press,
New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

M.Sc. Zoology I Semester

Session 2023-24

CORE COURSE

Paper-II

Structure and Function of Invertebrates

MM: 40

Unit. I - Origin and organization of Invertebrates

- Origin of Metazoa.
- **Organization of Coelom -**
  a) Acoelomates b) Pseudocoelomates c) Coelomates
- **Locomotion**
  a) Amoeboid, Flagellar and Ciliary movements in Protozoa
  b) Hydrostatic movements in Coelenterata, Annelida and Echinodermata.

Unit. II - Nutrition and digestion

a) Patterns of Feeding and digestion in Lower Metazoans, Mollusca and Echinodermata.
b) Filter feeding in Polychaeta.

- **Respiration**
  a) Organs of Respiration : Gills, Book lungs and Trachea
  b) Respiratory pigments of different phylogenic groups
  c) Mechanism of Respiration wsr prawn, scorpion and cockroach.

Unit. III - Excretion

a) Excretion in Lower invertebrates: Simple diffusion, Contractile vacuole and Protonephridia.
b) Excretion in Higher invertebrates: Coelom, Coelom duct , metanephridia , Coxal gland, Malphighian tubules, Organ of Bojanus and Green gland.

- Mechanism of Osmoregulation with special reference to Protozoa.

Unit. IV - Nervous system

a) Primitive Nervous System: Coelenterata and Echinodermata.
b) Advanced Nervous System: Annelida and Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda).

Unit .V – Invertebrate larval forms and Minor phyla –

- **Invertebrate larval forms and their evolutionary significance**
  a) Trematoda and Cestoda .
  b) Larval forms of Crustacea .
  c) Larval forms of Mollusca .
  d) Larval forms of Echinodermata .
- **Structure affinities and life history of the following Non – Coelomate and Coelomate Minor phyla :**
  a) Rotifera
  b) Entoprocta
  c) Phoronida
  d) Ectoprocta

Suggested Reading Materials:

1. Hyman, L.H. The invertebrates, Nol. I.protozoa through Ctenophora, McGraw Hill Co.,NewYork
2. Barrington,E.J.W. Invertebrate Structure and Function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York&London.
4. Hyman, L.H. The Invertebrates.Vol. 2. McGrawHill Co.,NewYork.
5. Hyman, L.H. The Invertebrates.Vol. 8.McGrawHill Co., New York and London.
6. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
7. Russel-Hunter,W.D. A biology of higher invertbrates, theMacmillanCo.Ltd.,London.
8. Hyman, L.H. The Invertebrates Smaller Coelomate Groups,Vol.V.Mc.Graw Hill Co.,NewYork.
9. Read, C.P.Animal Parasitism. Parasitism.prenticeHall Inc., NewJersey.
10. Sedgwick, A. A. Student textbook of Zoology. Vol.I,II andIII. CentralBook Depot, Allahabad.
11. Parker, T. J.,Haswell W.A. Textbook of Zoology, Macmillan Co., London.

M.Sc. Zoology I Semester

Session 2023-24

CORE COURSE

Paper-III

Quantitative Biology, Biodiversity and Wildlife

Unit I

MM: 40

- Central tendencies- mean, mode and median
- Measures of dispersion : range, mean deviation, standard deviation and coefficient of variation
- Chi-square test
- Normal distribution
- Experimental designing and sample method
- Basic mathematics for biologists wsr Matrices

Unit II

- Probability: distribution, properties and probability theory
- Randomized block design.
- Analysis of Variance[ANOVA]
- Co-relation- types of correlation
- Analysis of Co-efficient of correlation
- Linear Regression.
- Elementary idea of Duncan's Multiple Range test (DMRT)

Unit III

- Concept and principles of biodiversity
- Causes for the loss of biodiversity
- Biodiversity conservation methods wsr Ex-Situ and In- Situ Conservation.
- Intellectual property right (IPR) with special reference to India.
- Medicinal uses of forest plant (any five)
- Biodiversity hot spots.

Unit IV

- Wildlife of India according to ecological zones
- Values of wildlife: positive and negative

- Wildlife protection Act and its major amendments
- Endangered and threatened species
- Wildlife corridors and wildlife translocation.
- Animal ethics- Introduction, concept, organizations and their functions

Unit V

- National Parks and Sanctuaries
- Biospheres Reserves
- Tiger Reserve and Project Tiger
- Project Gir Lion and Crocodile breeding project
- Wildlife in M.P. with references to Reptiles, Birds and Mammals
- Study of state bird – Paradise fly catcher (Dudhraj) and State Animal -Swamp Deer (Barasingha)- *Cerves duvaucelli*

Suggested Reading Materials:

1. Batschelet. E. Introduction tomathematicsfor sitescientist springer-verlag,berling
2. Jorgenserr,S.E. Fundamental ofEcologicalmodlingE. sevierNewYork
3. Lenderen D.Modellinginbehavioral ecology.Chapman& Hall London U.K.
4. Sokal,R.R.andF.J.RohitBiometryFreemanSanFrancisco
5. Snedecor, G.W.andW.G. cochran, staticalmethods, Affilited East,WestPressNew Delhi (Indianed.)
6. Muray,J.D. MethamaticalBiology,SpringerVerlagBerlin
7. Pelon,E.C. The interpretationofecological data: Apromeronclassification and ordivation.
8. Wild life management –Hossetti
9. A.lewis.Biostatics
10. B.K. MahajanMethodsinBiostatics
11. V.B. Saharia wildlife in India
12. S.K.Tiwari wildlife in central India
13. J.D.MurreyMathematical Biology
14. Georgs&Wilians Startical method
15. R.K.Tandon BiodiversityTaxonomy & Ecology
16. M.P.Arora An Introduction to prevantology
17. P.C. Kotwal Biodiversity and conservation

M.Sc. Zoology I Semester

Session 2023-24

CORE COURSE

Paper-IV

Biomolecules and Structural Biology

Unit. I **MM: 40**

- Chemical foundation of biology -
  pH, pK, acids, Bases, Buffers, Weak bonds (Hydrogen bond, Vander waals force, Hydrophobic effects , Electrostatic force) .
- Resonance and Isomerisation - Sterioisomerisation- taking glucose as an example
- Acid soluble pool of living tissue – General idea of Aminoacids, Monosaccharides , Oligosaccharides, nucleotides and Peptides.
- Nanoparticles and its biological relevance.
- Elementary knowledge of Biomaterials.

Unit. II

- Primary, Secondary, Tertiary and quarternary structures of Proteins, Protein folding and denaturation.
- DNA and RNA : Double helical structure of DNA, Structure of RNA
- Role of RNA in gene expression, protein synthesis in eukaryotes.
- DNA replication, recombination and repair, Human disease-DNA repair failure
- Membrane channels -Voltage gated and Non- gated ion Channels
- Sodium – Potassium Pump.

Unit. III

- Basic concept of metabolism: coupled and interconnecting reactions of metabolism (intermediary metabolism), cellular high energy resources and ATP synthesis.
- Glycolysis and Gluconeogenesis
- Citric acid cycle.
- Oxidative phosphorylation.
- Fatty acid metabolism : degradation of fatty acids : Beta oxidation, brief idea of alpha and omega oxidation

Unit. IV

- RNA splicing
- m-RNA stability.
- Biosynthesis of Nonessential amino acids (glutamate & aspartate) from amphibolic compounds.
- Biosynthesis of Purines and Pyrimidines
- Biosynthesis of Cholesterol
- Lipid storage and its functional importance wsr to mobilization of fats from adipose tissue

Unit .V

- Enzymes : Terminologies, classification and basics of Enzyme kinetics
- Mechanism of Enzyme catalysis
- Regulation of enzyme reaction
- Concept of free energy and thermodynamic principles in Biology.
- Energy rich bonds, compounds and biological energy transducers
- Factors affecting mechanism of enzyme action
- Elementary knowledge of Ribozyme.

Suggested Reading Materials

- Voet, D. and J. G. Voet. Biochemistry John Wiley and Sons
- Freifelder, D. Physical Biochemistry W.H. Freeman and Co.

- Segal, I. H. Biochemical calculations John Wiley and Sons
- Creighton, T. E. Protein Structure and molecular properties W.H. Freeman and Co.
- Freifelder D. Essentials of molecular biology
- Wilson, K. and K.H. Goulding: A biologists guide to Principles and techniques of practical biochemistry
- Cooper, T. G., Tools of Biochemistry
- Hawk, Practical physiological chemistry
- Garret, R.H. and C.M. Grisham, biochemistry, Saunders College Publishers
- Lenhninger's Biochemistry
- Harper's Biochemistry
- G. P Talwar, Text book of Human biology and biochemistry
- Stryer, Text book of biochemistry

M.Sc. Zoology I Semester

Session 2023-24

ELECTIVE COURSE

Entomology

MM : 40

Unit. I

1. Outline classification of Class-Insecta upto orders according to Imms
2. General characteristic of all orders with common examples.
3. Collection and preservation of Insects.

Unit II

1. Insect head types and modification as per their habit and habitat
2. Modification of mouth parts and feeding behavior of insects
3. Structure types and function of antennae of insects
4. Sound Production in insect

Unit. III

1. Structure of cuticle and pigment of insects
2. Structure of alimentary canal and physiology of digestion in Cockroach.
3. Malphighian tubules – Anatomical organization and transport mechanism

Unit. IV

1. Respiratory system in Cockroach.
2. Circulatory system of Cockroach.
3. Cellular elements in the haemolymph
4. Cell mediated immunity.

Unit. V

1. Structure of compound eye and physiology of vision
2. Structure and function of endocrine glands wsr corpora cardiaca and corpora allata
3. Pheromones

Suggested Readings:

1. The Insect: Structure and function by R.F. Chapman
2. Comparative Insect physiology, Biochemistry and Pharmacology .Vol:1-13. Edited by G.A. Kerkut and L.I. Gilbert.
3. Entomophagous Insect by Clausen
4. Entomology bu Gilbert
5. Principles of Insect Physiology by Wigglesworth.
6. Fundamentals of Entomology by Elzinga
7. Hand book of economic Entomology for South India by Ayyar.
8. Insect cytogenetics by R.E.F.Symposium.
9. Insects and plants by Sting, Lawton and southwood.
10. Insect and hygiene by Busvine.
11. Insect Physiology by Wigglesworth.
12. Insect morphology by Mat Calf and Flint
13. Applied Agricultural Entomology by Dr. Lalit Kumar Jha

M.Sc. Zoology I Semester

Session 2023-24

ELECTIVE COURSE

Wild Life Conservation

MM: 40

Unit-1

1. Causes of depletion of wild life habitats.
2. Habitat analysis, Evaluation and management of wild life -
   (a) Physical parameters - Topography, Soil and water.
   (b) Biological Parameters – Food, cover and browse estimation.

Unit-2

1. Population estimation.
   (a) Fertility schedules and sex ratio computation.
   (b) Fecal analysis of ungulates and carnivores
   (c) Hair profile study and Pug mark method.
2. Objectives of National Organization.
   (a) Indian board of wild life.
   (b) Bombay Natural History Society
   (c) World wide fund of Nature
   (d)Wild life institute of India

Unit-3

1. Estimation of carrying capacity in protected areas.
2. Eco tourism / wild life tourism in forests.
3 Concept of climax persistence.

Unit-4

1. Bio- telemetry and Quarantine.
2. Common diseases of wild animal.
3. Care of injured and diseased animal

Unit-5

1. Protected areas of M.P wsr National parks & sanctuaries
2. Tiger reserve in M.P.
3. Management challenges in Tiger reserve.

Suggested Readings:

1. Gopal Rajesh: Fundamentals of wild life management
2. Agrawal K.C : Wild life India
3. Dwivedi A.P (2008) : Management wild life in India
4. Asthana D.K : Envionment problem and solution
5. Rodgers N.A & Panwar H.S : Planning of wild life / Protected area Network in India] vol. the report, wild life Institute of India Dehradun.
6. Odum E.P : Fundamentals of Ecology
7. Saharia V.B : Wild life in India
8. Tiwari S.K : Wild life in Central India
9. E.P Gee : Wild life of India
10. Negi S.S : Wild life conservation (Natraj Publishers

M.Sc. Zoology I Semester

Session 2023-24

Practical -I

1	Spotting- classification and identification of various phyla (5 spots)	10 marks
2	Spot related with adaptation and evolution, homologies, analogies and modification of mouth parts	4 marks
3	One major dissection of various system of invertebrates- – (Any 01) • Prawn • Other cultured animals	8 marks
4	One minor dissection – (Any 01) • Mouth parts / salivary gland of cockroach • Mouth parts of Honey bee	5 marks
5	Mounting material- Permanent balsam mount - Mouth parts of mosquito/**Separation of eggs and larvae from soil of local areas**	4 marks
6	(Any 01) • Estimation of gene and genotype frequencies in light of Hardy Weinberg Law • Study of human facial traits	5 marks
7	Study of polytene chromosome	4 marks
8	Viva-voce	5 marks
9	Practical records/collection	5 marks
Total		**50**

Practical -II

1	Spotting- (any 5)	10 marks
2	Exercise on mean, median and standard deviation	08 marks
3	Problem based on biodiversity and Wild life	08 marks
4	Elective Course Practical – Any 01 • Study of total haemocytes count in haemolymph • Dissection of Insect (Any 01) • Identification and comments upon wild animals of M.P. (any 05) • Preparation of checklist of Local Fauna / **Preparation of route maps to important National parks and sanctuaries of Madhya Pradesh**	04 marks
5	Demonstration of enzyme actions	05 marks
6	Estimation of pH.	05 marks
7	Viva-voce	05 marks
8	Practical records/collection	05 marks
Total		**50**

St. Aloysius College (Autonomous), Jabalpur
Department of Zoology
M.Sc. ZOOLOGY - II Semester
Choice Based Credit System (CBCS)
Scheme of Examination (Session 2023-24)

CORE COURSE
Paper-I
General and Comparative Animal Physiology and Endocrinology

MM: 40

Unit I
1. Respiratory pigments wsr Haemoglobin
2. Transport of oxygen and carbon dioxide in blood and body fluids and Chloride shift
3. Regulation of respiration
4. Physiology of impulse transmission through nerves and synapses
5. Autonomic nervous system, neurotransmitters and their physiological functions

Unit. II
1. Patterns of nitrogen excretion in different vertebrates
2. Comparative physiology of digestion in different vertebrates
3. Osmoregulation in different vertebrates
4. Thermoregulation in homeotherms and poikilotherms
5. Hibernation.

Unit. III
1. Comparative study of mechanoreception
2. Comparative study of photoreception
3. Comparative study of phonoreception
4. Comparative study of chemoreception
5. Comparative study of equilibrium reception

Unit. IV
1. Exocrine gland: Human salivary gland
2. Phylogeny of endocrine glands (pituitary and adrenal)
3. Ontogeny of endocrine glands (pituitary and adrenal)
4. Neuroendocrine system

Unit .V
1. Hormones, their classification and chemical nature
2. Mechanisms of hormone action -
   a. Hormone receptors
   b. Signal transduction mechanisms wsr Thyroid hormone
3. Hormones and reproduction wsr menstrual and ovarian cycle
   a. Seasonal breeders
   b. Continuous breeders

Suggested readings

- EJW, Barringtom, general and comparative endocrinology- Oxford, Claredon Press
- RH Williams- Text book of endocrinology-WB Saunders
- CR Martin-Endocrine physiology- Oxford University Press

- J Darnell, H Lodish and D. Baltimore, Molecular Cell Biology-Scientific American Books, USA
- B Alberts, D. Bray, J Lewis, M Raff, K Roberts and J D Watson, Molecular cell biology of the cell, Garland Publication New York

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-II

Population Ecology and Environmental physiology

Unit I **MM: 40**

1. Populations and their characters wsr natality, mortality, population growth forms, age pyramids, dispersal and density.
2. Demography: Life tables, generation time, reproductive value.
3. Population growth: Growth of organisms with non-overlapping generations, stochastic and time lag models of population growth, stable age distribution.
4. Population regulation: Extrinsic and intrinsic mechanisms.

Unit II

1.Adaptations: Levels of adaptions, Adaptations of muscle for diverse activities wsr jumping in frog and swimming in fishes.
2. Aquatic environments: Fresh water, marine, shores and estuarine environments.
3. Eco-physiological adaptations to fresh water environments wsr fishes.
4. Eco-physiological adaptations to marine environments wsr fishes and birds.
5. Eco-physiological adaptations to terrestrial environments wsr to reptiles and birds.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory- prey relationship, predator dynamics,
4. Mutualism wsr evolution of plant pollinator interaction.
5. Types of ecological niche and niche overlap.

Unit IV

1. Biodiversity Act and its amendments.
2. Environmental impact assessment – a general idea.
3. Sustainable development.
4. A general idea of biohazards and Biosafety Levels.
5. Introduction to bioremediation

Unit V

1. Concept of homeostasis wsr electrolyte balance.
2. Physiological response to oxygen deficient stress.
3. Physiological response to body exercise wsr to cardiac and respiratory system.
4. Meditation, yoga, Sleep Cycle and their effects

Suggested Readings:

1. Cherrett, J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.

2. Elseth, B.D. and K.M. Baumgartner, population Biology,Van NostrandCo., New York.
3. Jorgensen, S.E. Fundamentals of ecological modeling. Elsevier, NewYork.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs, C.J. Ecological Methodology. Harper and Row, New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H.Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation. Priceton, New Jersey.
8. Schmidt and Neilson- Adaptations and animal physiology

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-III

Tools and techniques in Biology

Unit.I **MM: 40**

1 Microsocopy, principle & applications

- Light microscope and phase contrast microscope
- Fluorescence microscope
- Electron microscope
- Confocal microscope

2. General Principle and applications of
   - Colorimeter
   - Spectrophotometer
   - Flame photometer
3. Principle, working and applications of fermenter.
4. Microbiological techniques
   - Methods of sterilization
   - Inoculation and growth monitoring.
   - Microbial identification (cytological staining methods for bacterial and fungal strains)

Unit. II

1. Communication skill in life science - Computer aided techniques for data presentation and data analysis wsr MS office, excel, power points for preparing scientific projects and assignments.
2. Cryotechniques
   - Cryopreservation of gametes.
   - Cryosurgery
   - Cryotomy
   - Freeze fracture and freeze drying.
3. Separation techniques.

Chromatography, principle, type and applications wsr Paper Chromatography, TLC & HPLC.

- Electrophoresis: Principles, types and applications PAGE and agarose gel electrophoresis.
- Principles of centrifugation, Ultra centrifuge, Organelle separation by centrifugation wsr Density gradient

Unit. III

1. Radioisotope and main isotope techniques in biology.
   a. Sample preparation for radioactive counting
   b. Autoradiography.
2. Immunological techniques
   -Immunodiffusion (Single & Double)
   -Immuno electrophoresis
3. Enzyme linked immunosorbent assay (ELISA) technique and its applications
4. Monoclonal antibody technology (Hybridoma technology)
5. Surgical techniques.
   - Organ ablation (eg. Ovariectomy, Adrenalectomy)

- Perfusion techniques
- Stereotaxy
- Indwelling catheters
- Parabiosis

6. Biosensors.

Unit .IV

1. Histological techniques
   a. Complete process of Microtomy
   b. Histochemistry wsr staining methods of Protein, carbohydrates and nucleic acids
2. Cell culture techniques.
   -Design and functioning of animal tissue culture laboratory
   -Culture media, essential components and Preparation
   -Cell toxicity and Cell viability testing.
3. Elementary idea of animal cell line.

UNIT V

1. Cytological techniques
   -Mitotic and meiotic chromosome preparations from insects and vertebrates.
   -Chromosome banding techniques (G.C.Q. R. banding)
   - Flowcytometry.
2. Molecular cytological techniques
   - Fluorescent in situ hybridization [FISH]
   - Restriction banding
3. Molecular biology techniques
   - Southern hybridization
   - Northern hybridization
   - DNA Sequencing
   - Polymerase chain reaction (PCR)
     RT-PCR

Suggested Reading Material

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry-
K, Wilson and K.H. GouldingElBSEdn.
3. Clark &Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
10. Robert Braun. Introduction to instrumental analysis. McGraw Hill

M.Sc. Zoology II Semester

Session 2023-24

CORE COURSE

Paper-IV

Molecular Cell Biology and Genetics

MM: 40

Unit.I

- Biomembrane wsr molecular composition arrangement and functional consequences
- Transport across cell membrane: diffusion, active transport, pumps, uniports, symports and antiports
- Micro filaments and microtubules structure and dynamics
- Cell movements: intracellular transport, role of kinesin and dynein

Unit . II

- G- Protein coupled cell surface receptors
- Cell-Cell signaling wsr G-protein and protein kinases mediated signaling.
- Target cells and effector organs.
- Second messenger system
- Cell cycle & Cyclin dependent kinases

Unit . III

- Cell-Cell adhesion and communication wsr :
  a) Ca++ dependent homophilic cell -cell adhesion –cadherin
  b) Ca++ independent heterophilic cell-Substratum adhesion – integrin
  c) Ca++ independent heterophilic cell-cell adhesion –Immunoglobulin super family molecules
- Gap junctions and connexins
- Hierarchy in Genome organization.
- Chromosomal organization of genes in coding and non-coding DNA
- Mechanism of Apoptosis
- Biology of Aging.

Unit .IV

- Sex determination in drosophila
- Sex determination in mammals
- Basic concept of dosage compensation
- Cytogenetics of human chromosomes
- Sex differentiation.

Unit . V

- General idea of human Genetic Diseases
  - Monogenic human Genetic Diseases – Chronic myeloid leukaemia
  - Chromosomal human Genetic Diseases – Cystic fibrosis, Thalassemia, Down's syndrome
- Human gene therapy

- Prenatal diagnosis & genetic counseling
- Genetic screening.
- Structural Genomics – Study of structure of genome (cytological and genetic mapping of chromosomes, RFLP mapping, Contig mapping, STS mapping)
- Functional Genomics – RNA and protein assay of genome function by study of expressed sequences through hybridization assay and gene chips
- Gene libraries
- Transgenic animals & Knockout animals, their applications

Suggested Readings

- J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
- B. Alberts D. Bray, J. Lewis, M. raff, K. roberts and J.D. Wattson. molecular biology of the cell. Garland Publishing Inc. New York.
- Masters John R. W. animal cell culture A practical approach. Irl. Press
- Alberts et. al Essentials cell biology garland publishing Inc. New York 1998
- J.M. Barry molecular biology
- Philip E. Hartman Gene Action
- L.C. dunn, principals of Genetics
- A.M. Winchester genetics
- Edgar Alterbrg Genetics
- L.C. Dunn genetics and the origin of species
- Bengt A. Kihlman actions of chemicals of dividing cells
- Snustad- principles of genetics
- Gardner-principles of genetics

M.Sc. Zoology II Semester

Session 2023-24

ELECTIVE COURSE
Applied Entomology

MM : 40

Unit. I

Modern concept of Pest management wsr:

1. Biological control of pests
2. Genetic control of pests
3. Chemical control of pests

Unit. II

1. Pest of Cotton (e.g., *Dysdercus koenigii)*
2. Pest of stored food grains (e.g., *Sitophilus oryzae)*
3. Pests of citrus fruits (e.g., *Dacus cucurbitae)*
4. Pest of pulse (e.g., *Callosobruchus chinensis)*
5. Pest of Vegetable (e.g., *Pieris brassicae)*

Unit. III

1. Insects in relation to forensic science
2. Insects of medical and veterinary importance
3. Ecological factors affecting development of insects
4. Insect migration, swarming and their hazardous effects in agriculture and forests

Unit . IV

1. Sericulture
2. Apiculture
3. Lac culture
4. Insects as human food and beneficial insects

Unit V

1. Structure of eggs and its types
2. Structure of larva and its types.
3. Structure of pupa and its types.
4. Metamorphosis.

Suggested Readings :

1. The Insect: Structure and function by R.F. Chapman
2. Comparative Insect physiology, Biochemistry and Pharmacology .Vol :1-13. Edited by G.A. Kerkut and L.I. Gilbert.
3. Entomophagous Insect by Clausen
4. Entomology bu Gilbert
5. Principles of Insect Physiology by Wigglesworth.
6. Fundamentals of Entomology by Elzinga
7. Hand book of economic Entomology for South India by Ayyar.
8. Insect cytogenetics by R.E.F.Symposium.
9. Insects and plants by Sting, Lawton and southwood.
10. Insect and hygiene by Busvine.
11. Insect Physiology by Wigglesworth.

12. Insect morphology by Mat Calf and Flint
13. Applied Agricultural Entomology by Dr. Lalit Kumar Jha

M.Sc. Zoology II Semester

Session 2023-24

ELECTIVE COURSE

Environment & Biodiversity Conservation

MM : 40

Unit I –
- Scope of Environmental Science
- Environmental monitoring and impact assessment.
- Water conservation wsr rain water harvesting and water shed management.
- Soil Problem in India and its management.

Unit II -
- Agriculture pollution
- Effects of Agricultural Practices on Biodiversity
- Basic concepts of Bioaccumulation.
- Environmental legislation.

Unit III
- Impact of global warming wsr acid rains and ozone depletion, green house effect. Control measures of global warming wsr (a) Afforestation (b) reduction in the use of CFCS.
- Disaster management wsr floods, earthquake and landslides.

Unit IV
- Use and over exploitation of Natural Resources wsr forests and water.
- Integrated forest management programmes in India
- Dams- benefits and problems
- Environmental effect of extracting and using mineral resources

Unit V
- World food problem wsr Role of genetic modified food as solution
- Using of alternate energy sources
- Biodiversity crisis wsr habitat degradation and poaching of wild life.
- Role of National Bureau of Animal Genetic Resources (NBAGR) in conservation of indigenous livestock biodiversity.

Suggested Readings :

1. Arora : Fundamentals of environmental biology
2. Anathakrishnan : Bioresources ecology
3. Bottain : Environmental studies
4. Bouhey : Ecology of populations
5. Clark : Elements of ecology
6. Dowdoswell : An introduction to animal ecology
7. Goldman : Limnology
8. Kormondy : Concepts of ecology
9. May : Model ecosystems
10. Odum : Ecology
11. Perkins : Ecology

12. Simmons : Ecology of estuaries and costal water
13. Pawlosuske : Physico-chemical methods for water
14. South Woods : Ecological methods
15. Trivedi and Goel : Chemical and biological methods for water pollution studies
16. Willington : Fresh water biology
17. Wetzal : Limnology
18. Welch : Limnology Vols. I-II

M. Sc. Zoology II Semester

Session 2023-24

Practical –I

1	Experiment on hematology: Detection of Human Blood groups, Total differential count, **Haemin crystal, Clotting time of human blood**	5 marks
2	Demonstration of Chromatography	10 marks
3	Problem based on demography -– Study of human fingerprints	05marks
4	• Detection of protein, carbohydrate, fats. • Detection of nitrogenous wastes	10 marks
5	• **Endocrinological spots:** T. S. of Pituitary gland, T. S. of Pancreas, T. S. of Thyroid, T. S. of Parathyroid ,T. S. of Thymus, T. S. of Adrenal gland , T. S. of Testis , T. S. of Ovary. • **Comments upon prepared histological slides of mammals:** T. S. of Oesophagus, T.S of Stomach , T.S of Intestine, T. S. of liver, T. S. of lungs, L.S. of Kidney.	10 marks
6	Viva-voce	5 marks
7	Practical records/collection	5 marks
Total		**50**

Practical –II

1	**Comments upon the principle and application of analytical instruments -**	10 marks
	• Colorimeter	
	• Spectrophotometer	
	• Ultracentrifuge	
	• ESR and NMR spectrometer/Agarose Gel Electrophoresis/SDS-PAGE	
	• Microtome	
	• Biochemical Analyzer • Elisa Plate Reader	
2	Elective Course practical – Any 01 • Taxonomic identification of pests of vegetables and stored grains of Jabalpur district (Any 05) • Study and identification of local biodiversity of Jabalpur district (Any 05).[Preparation of album /Scrap book]	04 marks
3	Problems based on genetics- Pedigree analysis - Collection of data on family history of some common genetic traits and preparation of pedigree chart	08 marks
4	Estimation of DNA / RNA	08 marks
5	Squash preparation to study meiosis of Grasshopper testis	5 marks
6	Demonstration of Chromosome Polymorphism, Isozyme Polymorphism in some insect population	5 marks
7	Viva-voce	5 marks
8	Practical records/collection	5 marks
Total		**50**

St. Aloysius College (Autonomous), Jabalpur

Department of Zoology

M.Sc. ZOOLOGY - III Semester

Choice Based Credit System (CBCS)

Scheme of Examination (w.e.f. Session 2023-24)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min. Marks For Passing
CORE COURSES				
ZC -301.	Comparative Anatomy of Vertebrates	4	40	14
ZC -302.	Limnology	4	40	14
ZC -303	Ecotoxicology	4	40	14
ZC -304	Aquaculture	4	40	14
ELECTIVE COURSE – (Any 01)				
ZE-305	• Sericulture • Animal Biotechnology	4	40	14
INTERNAL ASSESSMENT				
ZI -306	CCE-Written test (Based on core and elective Courses ZC- 301, 302 ,303, 304 & ZE-305) (Each test of 10 marks)	0	50	20 (04 in each Test)
ZI -307	Project/ Seminar	1	25	09
PRACTICALS				
ZP -308	Practical- I Based on Course ZC -301. & ZC -302.	2	50	18
ZP -309	Practical- II Based on Course ZC -303,ZC -304 & ZE-305.	2	50	18
SKILL BASED COURSE				
ZS-310	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**385**	**139**

M.Sc. Zoology III Semester

Session 2023-24

CORE COURSE

Paper I- Comparative Anatomy of Vertebrates

Max.M-40

Unit-1	1. Origin of Chordata : Concept of Protochordata 2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs) in Vertebrates. 3. Respiratory system: Characters of respiratory tissue, External and Internal Respiration. 4. Comparative account of Respiratory Organs.
Unit-2	1. 1. Evolution of heart. in vertebrates (Fishes, Amphibia, Reptile, Bird and Mammal). 2. Evolution of aortic arches and portal systems (Renal and hepatic). 3. Blood circulation in various vertebrates groups. 4. Comparative account of Jaw Suspensorium in Vertebrates. 5. Vertebral column of Fishes, Amphibia, Reptile, Bird and Mammal.
Unit-3	1.Evolution of urinogenital system in vertebrates (Fishes, Amphibia, Reptile, Bird and Mammal). 2.Comparative account of organs of olfaction and taste (Fishes, Amphibia, Reptile, Bird and Mammal). 3.Comparative anatomy of brain and spinal cord (CNS) (Fishes, Amphibia, Reptile, Bird and Mammal). 4. Comparative account of peripheral and autonomous nervous system in mammal.
Unit-4	1. Comparative account of lateral line system. 2. Comparative account of electroreception. 3. Flight adaptations in vertebrates. 4. Aquatic adaptations in birds and mammals.
Unit-5	1. Origin, evolution general organization and affinities of Ostracoderm. 2. General organization, specialized, generalized and degenerated characters of Cyclostomes. 3. Origin, evolution general organization of early Gnathostomes. 4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossopterygii.

SUGGESTED READINGS:

1. Carter,G.S.Structure and habit in vertebrate evolution–Sedgwick and Jackson,London.
2. Kingsley,J.S.Outlines of Comparative Autonomy of Vertebrates,Central Book Depot. Allahabad,
3. Kent,C.G.Comparative anatomy of vertebrates
4. MalcomJollie,Chordata morphology.East–WestPresPvt.Ltd.,NewDelhi.
5. MiltonIlildergr and.Analysis of vertebrate structure.IV.Ed.JohnWiley and SonsInc.,NewYork.
6. Smith,H.S.Evolution of Chordata structure.Hold Rinchart andWinstoin Inc. NewYork.
7. Sedgwick, A. A. Students : TextBook of Zoology,Vol.II.
8. Walter,H.E. and Sayles, L.D.Biology of vertebrates,MacMillan & Co.New York.
9. Romer,A.S.Vertebrate Body,IIIrdEd.W.B.SaundersCo.,Philadelphia
10. YoungJ.Z.life of vertebrates.The oxfordUniversityPress,London
11. Parker&Haswell to IIIRev.by Marshall willians latestedMacmillanCo.ltd.
12. YoungJ.Z.Life of mammals.TheOxfordUniversityPress,London
13. Weichert,C.K.andPresch,W.Elements of chordate anatomy,4th Edn. McGrawHall Book Co.,NewYork.

M.Sc. Zoology III Semester

Session Session 2023-24

CORE COURSE

Paper II-Limnology

Max.M-40

Unit-1	1. Limnology–Definition, historical development and scope of Limnology. 2.Types of fresh water habitats and their Ecosystem- (a) Ponds, Streams and rivers. (b)Lakes–Origin and classification. 3. Morphometry–Use of various morphometric parameters and Zonation.
Unit-2	Physico–Chemical Characteristics- 1. Light and Temperature- (a) Light as an ecological parameter in freshwater. (b) Temperature-Radiation, Stratification and Heat Budget. 2. (a) Dissolved Solids–Carbonate, Bicarbonates, Phosphate and Nitrate. (b) Physico–Chemical characteristics of fresh water with special reference to different parameters-Turbidity, dissolved gases (Oxygen, Carbondioxide, Hydrogen Sulphide), seasonal changes in dissolved gases and pH.
Unit-3	1. Study of Biota- (a) Phytoplankton, Zooplankton and their inter-relationship. (b) Aquatic insects, birds and their environmental significance. 2. Ecological classification of aquatic fauna. 3. Higher aquatic plants and their significance.
Unit-4	1. Methods of water quality testing BOD and COD. 2. Sewage– Definition, composition and its treatment. 3. Bioindicators - Aquatic flora and fauna in relation to water quality in an aquatic environment.

Unit-5	1. Causes of pollution of aquatic resources, their management and conservation. 2. Resource Conservation–Aquatic pollution & its control, 3. Legislation and regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs. 3. Use and misuse of inland waters.

Suggested Readings:

Anathakrishnan	:	Bioresources Ecology
Goldman	:	Limnology
Odum	:	Ecology
Pawlosuske	:	Physico-chemical methods for water
Wetzal	:	Limnology
Trivedi&Goyal	:	Chemical and biological methods for water pollution studies
Welch	:	Limnology Vols.I-II
Perkins	:	Ecology
Arora	:	Fundamentals of environmental biology
Ghoshe	:	Toxicology
Sood	:	Toxicology

M.Sc. Zoology III Semester

Session 2023-24

CORE COURSE

Paper III - Ecotoxicology

Max M-40

Unit-1	1. General principles of Environmental Biology with emphasis on ecosystems. 2. Abiotic and biotic factors of ecosystems. 3. Communities of the environment, their structure &significance. 4. Energy flow in environment: Ecological energetics.
Unit-2	1. Productivity, Production and analysis. 2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation. 3. Remote Sensing–basic concepts and applications of remote sensing techniques in environmental conservation. 4. Environmental indicators and their role in environmental balance.
Unit-3	1. Air and Water pollution and their control methods. 2. Radioactive compounds and their impact on the environment. 3. Vehicular exhaust pollution, causes and remedies. 4. Noise pollution.
Unit-4	1. Toxicology-Basic concepts, toxicological methods. 2. Toxicity testing principles, hazards, risks and their control methods. 3. Food toxicants and their control methods. 4. Public Health Hazards due to environmental disasters.
Unit- 5	1.Pesticides, types, nature and their effects on environment. 2.Agrochemical use and misuse, alternatives. 3.Important heavy metals and their role in environment. 4..Occupational Health Hazards and their Control.

SUGGESTEDREADINGS:

1.Clark	:	Elements of ecology
2.Odum	:	Fundamentals of Ecology
3.SouthWoods	:	Ecological methods
4.Trivedi and Goel	:	Chemical and biological methods for water pollution studies
5 Ghoshe	:	Toxicology
6 Sood	:	Toxicology

M.Sc. Zoology III Semester
Session 2023-24
CORE COURSE
Paper IV – Aquaculture

Max M: 40

Unit-1	1. Aquaculture: history, definition, scope & importance. 2. Inland Fisheries resources of MP- wsr Narmada 3. Riverine fisheries- Ecology and Fishes of Major River Systems wsr Ganga, Brahmaputra, East coast river system, Godavari and Cauvery river system. 4. Cold water fisheries in India. 5. Coastal fisheries in India. 6. General ecological characteristics of reservoirs of India.
Unit-2	1. Fish culture wsr Mono and Poly/ Mixed/ Composite Fish culture. 2. Fresh Water Prawn Culture and its prospects in India. 3. Culture of Oysters 4. Pearl culture and Pearl industry. 4. Frog culture.
Unit-3	1. Overview of Integrated fish culture 2. Paddy cum fish culture 3. Sewage fed fish culture. 4. Brackish water culture. 5 Cage Culture

Unit-4	1. Fresh water fish farm Engineering: Selection of site, soil chemistry of fish farm, designing of fish farm, Layout & construction of fish farm. 2. Types of fish ponds. 3. Setting and management of fresh water aquarium wsr feeding and Nitrogen cycle 4. Aquarium fishes –Types and characteristics, Breeding of aquarium fishes. 5. Different types of crafts and gears in fisheries
Unit-5	1. Water pollution, its effects on fisheries and methods of its abatement. 2. Common fish diseases & their control. 3. Biochemical composition and nutritional value of fishes. 4. Nutrigenomics and immune function in fishes. .

Suggested Readings:

1. C.B.L.Shrivastava	:	Fishes of India
2. Jhingaran	:	Fish and fisheries of India
3. S.S.Khanna	:	An Introduction to fishes
4. R.S.Rath	:	Fresh waterAquaculture
5. Gopalji Shrivastava	:	Fishes of U.P.& Bihar
6. H.D.Kumar Fisheries	:	Sustanibility & Management of Aquaculture
7. A.J.K.Mainan	:	Identification of fishes
8. R.Sanatam	:	A Manual of freshwater Aquaculture
9. S.K.Gupta	:	Fish & Fisheries
10.P.D.Pandey	:	Fish & Fisheries
11.K.P.Vishwas	:	Fish & Fisheries

M.Sc. Zoology III Semester
Session 2023-24
ELECTIVE COURSE
Sericulture

Max M : 40

Unit-1	Introduction and Moriculture: 1. Historical background of sericulture, Scope of sericulture & Entrepreneurship in silk industry 2. Silk Producing organisms and types of silk. 3. Classification of races of *Bombyx mori.* 4. Life cycle of *Bombyx mori* 5. Propagation of Mulberry plant. 6. Process of Sericulture
Unit-2	Plant Pathology, silkworm diseases and Biology of Bombyx mori wsr: 1. Diseases of mulberry plant. 2. Diseases of silkworms wsr Pebrine (Protozoan disease), Bacterial, Fungal and Viral diseases *3.* Silk gland of *Bombyx mori.* 4. Structure & chemical composition of silk.
Unit-3	Rearing facilities and operation wsr: 1. Rearing house and appliances for rearing of silk worms. 2. Disinfection operation before rearing of silk worms 3. Maintenance of optimum conditions for rearing. 4. Feeding, Bed cleaning and spacing
Unit-4	Moulting and Mounting wsr: 1. Moultanism . 2. Care during Moulting of silk worm. 3. Characteristic features of ripe silk worm 4. Process of mounting of silk worm. 5. Process of spinning & harvesting of cocoons
Unit-5	Cocoon Marketing, Silk Reeling and Non-Mulberry Silk Worm wsr: 1. Cocoon Quality. 2. Testing and grading of cocoon. 3. Silk reeling operation. 4. Non-Mulberry Silk Worm culture wsr Tasar culture, Eri culture and Muga culture.

List of books for Sericulture:

1. Hand book of Silk Worm rearing by Masanori, Shimiza,D. Agri.
2. Sericulture Manual -2
3. Sericulture Manual -3 by S. Kishanaswamy
4. Introduction to Sericulture by Dr. (Mrs.) G. Ganga Dr. (Mrs.) J. Sulochanachetty
5. Principles of Sericulture by HisaoAruga
6. A Manual of non-mulberry Silks Sericulture Vol.-1 by Dr. M.S. Jolly.*et al*
7. Sericulture and Silk Industries by TripurariSharan
8. Sericulture Manual -1 Mulberry cultivation by Dr. G. Rang swami
9. Sericulture Manual -2 Silkworm rearing by Dr. S. Krishnaswami
10. Sericulture Manual -3 Silk reeling by Dr. S. Krishnaswami
11. Mulberry cultivation by Zheng, Ting-Zing
12. Silkworm rearing by Pva Pang- Chesan
13. Silk worm training manual by ScoHotim.

M.Sc. Zoology III Semester
Session 2023-24
ELECTIVE COURSE
Animal Biotechnology

Max M : 40

Unit-1	1. Structure and organization of animal cell 2. Elementary idea of equipments and materials for animal cell culture technology. 3. Primary and established cell line cultures. 4. Brief account of balanced salt solution and chemical, physical and metabolic functions of different constituents of commonly used culture mediums. 5. Role of carbon dioxide, serum and supplements in animal cell culture.
Unit-2	1. Serum and protein free defined media and their application, 2. Measurement of viability and cytotoxicity; 3. Biology and characterization of the cultured cells, 4. Measuring parameters of growth. 5. Basic techniques of mammalian cell culture in vitro.
Unit-3	1. Disaggregation of tissue and primary culture. 2. Maintenance of cell culture. 3. Scaling up of animal cell culture 4. Cell separation 5. Cell synchronization 6. Cell cloning and micromanipulation 7. Cell transformation.
Unit-4	1. Embryonic stem cells and their culture. 2. Epithelial stem cells culture. 3. Application of animal cell cultures. 4. Cell culture-based vaccines. 5. Somatic cell genetics. 6. Introduction of assisted reproductive technologies for genetic improvement of farm animals.
Unit-5	1. Organ and Histotypic culture. 2. Elementary idea of Cell Senescence and apoptosis 3. Measurement of cell death. 4. Brief account of three-dimensional culture and tissue engineering. 5. Culture collection centers for animal cell lines.

Recommended Books

1.Culture of Animal Cells (3 rd Edition), R. lan Freshmney.- Wiley Liss.
2.Animal Cell Culture -Practical Approach, (Ed) John R.W. Masters, Oxford.
3.Cell Growth and Division' A Practical Approach. (Ed.) R. Basega, IRL Press.
4.Cell Culture Lab Fax. (Eds). M. Buller & M. Dawson, Bios Scientific Publication Ltd. Oxford.
5 Animal Cell Culture Techniques. (Ed.) Martin Clynes, Springer.
6.Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods, (Ed.) Jenni P.
7.Mather and David Barnes, Academic Press

M.Sc. III Sem- Zoology

Session– 2023-24

Practical I: Related to I & II Theory Papers

1. Study of Specimens, slides and bones Wsr Vertebrates.
2. Major Dissection- General anatomy of cranial nerves of Labeo and Wallago.
3. Minor Dissection of Weberian ossicles (Labeo/Wallago)
4. Estimation of DO, Chloride, BOD, COD, Hardness, pH and Alkalinity of water.
5. Detection of presence of bacteria in soil
6. Study of freshwater ecosystem (Pond/Aquarium) **wsr Adharthal pond and Robertson lake.**
7. Study of Bioindicators.

Scheme for Practical Examination M.M.50

1.	Major Dissection	10 Marks
2.	Minor Dissection	04 Marks
3.	Spotting	12 Marks
4.	Limnological exercise	10 Marks
5.	Comment upon bioindicators	04 Marks
6.	Practical Record	05 Marks
7.	VivaVoce	05 Marks
	Total	**50 Marks**

M.Sc. III Sem- Zoology
Session– 2023-24
Practical II: Related to III
& IV and Elective Course
Theory Papers

1. Study of plankton of **local waterbodies**.
2. Preparation and Maintenance of Aquarium.
3. Study of common weeds of **local** fish ponds/**study of aquarium fishes.**
4. Methods of culture related to theory papers.
5. Study of abiotic factors of water related to fish life (Turbidity, Conductivity)
6. Determination of different toxic chemicals in samples of soil, water and air.
7. Toxicological testing methods, General tests, acute toxicity test and LD**50** test.
8. Identification and comments on Aquaculture animals:

   Coral-Acropora millipora, Prawn , Crab, Pila, Unio, Labeo,Catla, Wallago, Cirrhina reba, Rana tigrina .

Elective Paper (Sericulture)

8. Preparation of Map showing extension of sericulture in India
9. Identification of Major Silk worm pest
10. Life cycle of *Bombyx mori*.

Elective Paper (Animal Biotechnology)

11. MTT assay
12. In vitro Cell viability test
13. Cell separation using HiSep

Scheme of practical examination

1.	Spotting	12
2.	Identification and comments upon Silkmoths / Life cycle of *Bombyx mori* / MTT assay / Invitro Cell viability test/Cell separation using Hisep	04
3.	Exercise on toxicology	10
4.	Study of culture methods related to theory	05
5.	Experiment on conductivity/turbidity	10
6.	Viva Voce	04
7.	Practical Record, Field visit report and Collection	05
	Total	**50**

St. Aloysius College (Autonomous), Jabalpur

Department of Zoology

M.Sc. ZOOLOGY - IV Semester

Session 2023-24

Choice Based Credit System (CBCS)

Course No.	Course Title	Credits	Marks	
			Max. Marks	Min.Marks For Passing
CORE COURSES				
ZC-401.	Animal Behaviour and Neurophysiology	4	40	14
ZC -402.	Gamete Biology, Development and Differentiation	4	40	14
ELECTIVE COURSE - (Any 01)				
ZE -403	• Pure and Applied fisheries • Molecular Endocrinology and Vertebrates Immune System	4	40	14
ZD -404	**DISSERTATION**			
	Abstract Review of literature Methodology Analysis and interpretation Presentation Viva	4	05 05 05 10 10 15 50	18
INTERNAL ASSESSMENT				
ZI -405	CCE-Written test (Based on ZC -401, 402 & ZE -403) (Each test of 10 marks)	0	30	12 (04 in each Test)
ZI -406	Internship Project	4	50	18
ZI -407	Comprehensive • Viva-Voce • Report	1	50	18
PRACTICALS				
ZP -408	Practical- I Based on Course ZC -401 & ZC-402	2	50	18
ZP -409	Practical- II Based on Course ZE -403	2	50	18
SKILL BASED COURSE				
ZS-410	Skill Based Course	1	10	4
Total Credits & Total Marks		**26**	**410**	**148**

Scheme of Examination (w.e.f. Session 2023-24)

Session 2023-24

CORE COURSE

Paper I- Animal Behaviour and Neurophysiology Max.M.-40

Unit-1	1.Introduction: - Ethology as a branch of biology. - Animal psychology, classification of behavioral patterns, analysis of behavior (ethogram) 2. Reflexes and complex behaviour. 3. Perception of the environment wsr mechanical, electrical, chemical, olfactory, auditory and visual receptors . 4. Evolution of proximate and ultimate causation wsr inheritance of behavior and relationships.
Unit-2	1. Neural and hormonal control of behaviour. 2. Genetic and environmental components in the development of behaviour. 3. Motivation: Drive,timing and interaction of drives, physiological basis of motivation, Hormones and motivation. 4. Types of Communication: Chemical, visual, light, audio communication and sonotaxonomy wsr bird call. 5. Evolution of language (primates). 6 Bioluminescence and Colouration in fishes
Unit -3	1.Ecological aspects of behaviour: Habitat selection, food selection, Optimal foraging theory, anti-predator defenses, homing territoriality, dispersal, host parasite relations. 2.Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds. 3.Learning and memory: Association learning wsr conditioning, habituation, insight learning and reasoning 4.Memory –Basic concept and types

Unit-4	1.Reproductive behaviour.Evolution of sex and reproductive strategies,mating systems,courtship,sexual selection., Parental care in fishes . 2.Social behaviour. Aggregations,Schooling in fishes,Flocking in birds,Herding in mammals, Group selection, 3. Kin selection. 4. Social organization in insects and primates.
Unit-5	1. Human Ethology -Ethological concept and human behavior. -Concept of sign stimuli. -Concept of imprinting. -Kinships of human social systems -Human Pheromones. 2. Territorial behavior. 3. Aggressive behavior. 4. Altruism

Suggested Readings-

1.Eibl-Eibesfeldt, I.Ethlogy.The biology of Behaviour.Holt, Rineheart & Winston, NewYork.

2.Gould, J.L. The mechanismand Evolution of Behaviour.

3.Kerbs,J.R.and N.B.davies:Behaviourable Ecology.Blackwell,Oxford, U.K.

4.Hinde, R.A. Animnal Behaviour: A Synthesis of Ethology and Comparative Psychology. McGrawHill, NewYork.

5.Alcock, J. AnimalBehaviour :An Evolutionary approach.Sinauer Assoc.Sunderland, Massachsets,USA.

6.Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication.Sinauer Assoc.Sunderland,Massachsets,USA.

M.Sc. Zoology IV Semester

Session 2023-24

CORE COURSE

Paper-II - Gamete Biology, Development and Differentiation **M.M-40**

Unit-1	1. Differentiation of gonads in mammals and its genetic basis. 2. Spermatogenesis: Morphological basis in rodents. 3. Gamete specific gene expression and genomics 4. Biochemistry of Semen: Semen composition and formation, assessment of sperm function. 5. Fertilization: Pre fertilization events biochemistry of fertilization post fertilization events.
Unit-2	1. Ovarian follicular growth and differentiation: morphology, endocrinology, molecular biology of oogenesis 2. Vitellogenesis in Amphibia. 3. Hormonal regulation of ovulation and ovum transport in mammals. 4. Multiple ovulation and embryo transfer technology wsr in vitro oocyte maturation, superovulation and elementary idea of IVF.
Unit-3	1. Hormonal regulation of pregnancy and parturition. 2. Hormonal regulation of development of mammary gland and lactation. 3. Endocrinology and Physiology of placenta. 4. Cryopreservation of Gametes and Embryo. 5 Teratological effects of Xenobiotic on gametes. 1. Melanogenesis.

Unit-4	1. Cell commitment and differentiation. 2 Germ cell determinants and germ cell migration. 3 Early development of fish upto gastrulation 4 Types of morphogenetic movements in Frog. 5 Concept of totipotency and pleuropotency. 6 Competence and Induction, primary and secondary inducers. 7 Primary neurulation.
Unit-5	1. Stem cell concept: Potency definition of stem cells, Embryonic and adult stem cell. 2. Adult stem cell niches. 3. Mesenchymal stem cells. 4. Epidermal stem cell culture. 5. Connective tissue cell family 6. Haemopoietic stem cells: Blood cells formation, 7. Stem cell disorders.

SuggestedReadin g:

1. Long J.A.EvanH.M.1922: The oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou.A.C.–Reproductive physiology
3. PrakashA.S.1965-66Marshall's,Physiology Reproduction(3Vol.)
4. Gilbert,S.F.Developmenal Biology,SinauerAssociated Inc.Massachulsetts.
5. EthanBier,the cold Spring.The cold spring Harbor laboratory Press,NewYork.
6. BalinskyB.I.Introduction to Embryology sanders,Phliedelphia.
7. Berril N.J.and Karp.G.Development Biology.McGrawHill NewYork.
8. Davidson,E.H.Gene Activity During Early Development.Academic Press,New York.

M.Sc. Zoology IV Semester

Session 2023-24

ELECTIVE COURSE

Paper III: Pure and Applied fisheries

Max M.: 40

Unit-1	1. Origin and outline of evolution of fishes 2. Classification of fishes as proposed by Berg 3. Structure of fish integument, development of placoid scale and types of Scales. 4. Growth studies wsr Age determination in fishes. 5. Elementary idea of morphometric and meristic characters of fishes. 6. Locomotion in fishes
Unit-2	1. Alimentary canal and digestion in Elasmobranch [Scoliodon] and teleost fish [Clarias]. 2. Accessory respiratory organs wsr in Clarias, Anabas and Heteropneustes. 3. Air bladder, Weberian ossicles and their functions. 4. Structure of heart and arrangement of blood vessels in gills. 5. Excretion and Osmoregulation.
Unit-3	1. Nervous system of fishes. 2. Venomous fishes. 3. Deep sea adaptations in fishes. 4. Hill stream adaptations in fishes. 5. Migration in fishes 6. Sexual cycle and fecundity of fishes

Unit-4	1. Collection of fish seed from natural resources. 2. Dry and Wet Bundh breeding of carps. 3. Method of Hypophysation . 4. Importance of genetic engineering in fishes with examples. 5. Quarantine measures- Fish quarantine procedure. 6. Basic varieties of fish feed.
Unit-5	1. Management of Hatcheries, Nurseries and Rearing Pond. 2. Management of stocking ponds. 3. Common aquatic weeds and control. 4. Methods of fish preservation. 5. By product of fishes. 6. Transport of live fish & fish seeds. 7. Marketing of fishes in India.

Suggested Readings:

1. C.B.L.Shrivastava : Fishes of India
2. Jhingaran : Fish and fisheries of India
3. S.S.Khanna : An Introduction to fishes
4. R.S.Rath : Fresh waterAquaculture
5. Gopalji Shrivastava : Fishes of U.P.& Bihar
6. H.D.Kumar : Sustanibility & Management of Aquaculture Fisheries
7. A.J.K.Mainan : Identification of fishes
8. R.Sanatam : A Manual of freshwater Aquaculture
9. S.K.Gupta : Fish & Fisheries
10. P.D.Pandey : Fish & Fisheries
11. K.P.Vishwas : Fish & Fisheries

M.Sc. Zoology IV Semester
Session 2023-24
ELECTIVE COURSE

Paper III: Molecular Endocrinology and Vertebrates Immune System

Max M. : 40

Unit-1	1. Chemical nature of hormones. 2. Mechanism of hormone action. 3. Regulation of T_3& T_4 hormone concentration in blood 4. Hormonal Control of Gene Expression wsr Glucocorticoid 5. Eicosanoids and their hormone action.
Unit-2	1. Bioassay of Androgen wsr androgen doping 2. Hormonal regulation of energy metabolism. 3. Hormone receptor antagonist and antihormone therapy 4. Hypothalamic nuclei and their physiological function. 5. Extraction of Gonadotropin from urine

Unit-3	1. Tissues of Immune system- Primary lymphoid organs (Thymus),Secondary lymphoid organs (Spleen). 2. Immune cells wsr lymphocytes ,macrophages and natural killer cells 3. Antigen processing and presentation 4. B-cell and T-cell receptor 5. B-cell and T-cell activation.
Unit-4	1. Structure and types of Immunoglobulin 2. Gene model for Immunoglobulin gene structure wsr Two Gene Model of Dreyer and Bennett 3. Autoimmune diseases wsr autoimmune haemolyticanaemia 4. Antibody dependent cytotoxic reaction. 5. Delayed type cell mediated hypersensitivity type IV reaction.
Unit-5	1. Immunodiagnostics with special reference to – a) Immunostaining wsr Immunohistochemistry b) Immunoblotting / western blot c) Immunochromatography. 2. Immunization .

Suggested Readings:

1. Principles of Anatomy and *Physiology*, Gerard J. *Tortora*,
2. Benjamin Lewim – Genes VII/ VIII, oxford University press.
3. Lodishetal- Molecular Cell Biology.
4. Zarrow, M.X., Yochin J.M. and Machrthy, J.L. – ExperimentalEndocrinology.
5. Chatterji C.C.- Human Physiology (Vol- II).
6. Bentley, P.J. – Comparative Vertebrate endocrinology.
7. Hadley Mac. E.- Endocrinology.
8. Chinoy, N.J. Rao, M.V., Desarai, K.J. and High land, H.N. – Essential techniques in reproductively physiology and Endocrinology.
9. Norris, D.O. – Vertebrate Endocrinology.
10. Kuby, Immunology, W.H. Freeman, U.S.A.
11. W. Paul. Fundamentals of Immunology.
12. I.M. Roitt. Essential Immunology, ElBS Edition.
13. David Randall:Animal Physiology (Eckert's)
14. D.P. Anderson: Text Book of Fish Immunology.
15. Joshi & Osamo : Immunology & Serology
16. David Male: Advanced Immunology

M.Sc. Zoology IV Semester

Session 2023-24

Practical-I

(Based on Core Courses: Paper I & II)

M.M.:50

1. Exercise on Animal behavior

a) Taxes – Hydrotaxis, Chemotaxis, Geotaxis, Phototaxis
b) Reflexes
c) Social behavior
d) Learning behavior- Trial and error learning using step maze

2. Developmental Biology

a) Study of embryological slides [Frog & chick]
b) Preparation of permanent chick mount **of local poultry farm**
c) Study of different stages of spermatogenesis (slides of meiosis)
d) Semen analysis –sperm count and sperm motility

Scheme for Practical Examination

1.	Exercise based on animal behavior	20
2.	Exercise based on developmental biology	15
3.	Practical record / Collection	10
4.	Viva Voce	05
	Total	**50 Marks**

M.Sc. Zoology IV Semester

Session 2023-24

Practical-II

(Based on Elective Course : Paper III)

1. Major dissection Nervous system of Scoliodon and Digestive system of Clarias
2. Minor Dissection-Accessory respiratory organs /Reproductive system of Clarias /Heteropneustes
3. Age determination of teleost fish with the help of scales
4. Identification of **commercially important locally available fishes** (10 fishes)
5.Spotting of museum Specimen, slides and bones of fishes.

Scheme for Practical Examination

Time: 5 hour	**M:M 50**
1. Major dissection.	10
2. Minor dissection	06
3. Age determination of fish with the help of scales.	05
4. Identification of fish.	06
5. Spotting of museum specimen, slides and bones.	08

6. Viva Voce.	05
7.Practical record & survey of local fish market .	10
Total	**50**

M.Sc. Zoology IV Semester

Session 2023-24

Practical-II

(Based on Elective Course: Paper III)

1. Western Blotting.
2. Widal screening test.
3. Detailed histological structure of Major Lymphoid Organs like spleen, thymus, Bone marrow, lymph nodes and Peyer's patches.
4. Demonstration of antigen and antibody reaction through simple experiments
    a. Agglutination
    b. Immunodiffusion
    c. Immunoelectrophoresis
5. ELISA
6. Viva Voce
7. Practical record & Survey of diseases recorded in local hospitals

Scheme for Practical Examination

Time: 5 hour	**M:M 50**
1. Western Blotting.	10
2. Immunodiffusion	06
3. Widal screening test.	05
1. ELISA/ Immunoelectrophoresis	06

2. Spotting based of slides of Major Lymphoid Organs.	08
3. Viva Voice.	05
7. Practical record & Survey of diseases recorded in local hospitals	10
Total	**50**

SYLLABUS

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POLITICAL SCIENCE

St. Aloysius College (Autonomous) Jabalpur
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2022- 23

M.A. I Semester एम.ए.प्रथम सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	I प्रथम		
Title of the paper प्रश्नपत्र का शीर्षक	Indian Political Thought भारतीय राजनीतिक चिंतन		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Overview of Indian Political Thought, Genesis and Development. The Renaissance- Raja Ram Mohan Roy, Balgangadhar Tilak, Vivekananda
इकाई–1	भारतीय राजनीतिक विचार का अवलोकन, उत्पति और विकास। पुर्नजागरण–राजा राममोहन रॉय, बाल गंगाधर तिलक, विवेकानन्द।
Unit-2	Influences on the Ideas of Mahatma GandhiSatya, Dharma, Shanti, Prem, Ahimsa, Asteya, Aparigraha, Swadeshi, Roti ke liye Sharm, Brahmacharya, Political Leader and Political Activist. Gandhi as an Statesman, Gandhi as an Economist Activist.
इकाई–2	महात्मा गांधी के विचारों पर प्रभाव, सत्य, धर्म, शांति, प्रेम, अहिंसा, अस्तेय, अपरिग्रह, स्वदेशी, रोटी के लिए श्रम, ब्रह्मचर्य, गांधी एक राजनीतिक नेता और राजनीतिक कार्यकर्ता, गांधी एक राजनेता के रूप में, गांधी एक आर्थिक कार्यकर्ता के रूप में ।
Unit-3	Political Ideas of Pandit Jawahar Lal Nehru, Sir Sayyed Ahmad Khan, Mo. Ali Jinnah, Dr. Bhimrao Ambedkar.
इकाई–3	पं. जवाहरलाल नेहरू, सर सैय्यद अहमद खान, मो. अली जिन्ना, डॉ. भीमराव अम्बेडकर के राजनीतिक विचार।
Unit -4	Views of Ram Manohar Lohia, Jai Prakash Narayan, Acharya Narendra Rao.
इकाई–4	राम मनोहर लोहिया, जय प्रकाश नारायण, आचार्य नरेन्द्र देव के विचार ।
Unit-5	Views of Din Dayal Upadhyay, M.N. Rai, Arvind Ghosh.
इकाई–5	दीन दयाल उपाध्याय, एम.एन. राय, अरविन्द घोष के विचार।

St. Aloysius College (Autonomous) Jabalpur
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M.A. I Semester एम.ए.प्रथम सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	II द्वितीय		
Title of the paper प्रश्नपत्र का शीर्षक	Indian Government And Politics भारतीय शासन और राजनीति		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Indian Constitution: Making of the Indian Constitution. Characteristics of Indian Constitution. Preamble. Fundamental Rights and Directive Principles of State Policy. Amendment Process. Federalism, Centre-State Relations.
इकाई–1	भारतीय संविधान :– भारतीय संविधान का निर्माण,, भारतीय संविधान की विशेषताएँ, प्रस्तावना, मौलिक अधिकार एवं राज्य के नीति निर्देशक तत्व, संशोधन प्रक्रिया । संघवाद, केन्द्र – राज्य सम्बन्ध ।
Unit-2	Union Government: President, Prime Minister and Council of Ministers, Parliament. Supreme Court of India. Judicial Review and Judicial Activism.
इकाई–2	केन्द्रीय सरकार : राष्ट्रपति, प्रधानमंत्री और मंत्रिपरिषद्, संसद। भारत का सर्वोच्च न्यायालय, न्यायिक पुनरावलोकन और न्यायिक सक्रियता।
Unit-3	Political Parties and Pressure Groups. Nature of Party System, Major National Political Parties and Regional Political Parties. Pressure Groups: Types and Functioning.
इकाई–3	राजनीतिक दल : दलीय व्यवस्था की प्रकृति, प्रमुख राष्ट्रीय राजनीतिक दल और क्षेत्रीय राजनीतिक दल, दबाव समूह : प्रकार और कार्य पद्वति।
Unit -4	Determinants of Indian Politics: Caste, Communalism, Regionalism, Language, OBC and Dalits. Politics of Coalition Governments in India. Criminalization of Indian Politics.
इकाई–4	भारतीय राजनीति के निर्धारक तत्व :–जाति, सम्प्रदायवाद, क्षेत्रीयतावाद ,भाषा ,पिछड़ा वर्ग एवं दलित। भारत में साझा सरकारों की राजनीति, भारतीय राजनीति का अपराधीकरण।
Unit-5	Meaning, Nature and Determinants of State Politics. Impact of State Politics on National Politics. Comparative Study of Human Development Index of Indian States.
इकाई–5	राज्य राजनीति का अर्थ, प्रकृति एवं निर्धारक तत्त्व । राष्ट्रीय राजनीति पर राज्यों की राजनीति का प्रभाव । राज्यों के मानव विकास सूचकांक का तुलनात्मक अध्ययन ।

St. Aloysius College (Autonomous) Jabalpur
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M.A. I Year एम.ए.प्रथम वर्ष			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	International Politics & Contemporary Political Issues अंतर्राष्ट्रीय राजनीति और समसामयिक मुद्दे		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Meaning, Nature and Scope of International Politics. Theories of International Politics: Realism & Idealism, System Theory and Decision Making Theory.
इकाई–1	अंतर्राष्ट्रीय राजनीति : अर्थ, प्रकृति और क्षेत्र। अंतर्राष्ट्रीय राजनीति के सिद्धान्त : यर्थाथवाद, आदर्शवाद, व्यवस्था सिद्धान्त और निर्णय निर्माण सिद्धान्त।
Unit-2	The Elements of National Power and Limitations, Balance of Power and Collective Security: Imperialism, Colonialism, New Colonialism and War. National Interest and International Ideology, Morality
इकाई–2	राष्ट्रीय शक्ति के तत्व और सीमाएं, शक्ति संतुलन और सामूहिक सुरक्षा, साम्राज्यवाद, उपनिवेशवाद, नवउपनिवेशवाद और युद्ध। राष्ट्रीय हित और अंर्तराष्ट्रीय विचारधारा, नैतिकता।
Unit-3	The Concept of Non-Alignment: Bases, Role and Relevance, Regional Cooperation: SAARC, ASEAN, OPAC, OAS, Disarmament and Arms Control: CTBT, NPT, PNE, Cold War and beginning of the New Détente. End of Cold War, Contemporary Political Issues After in Post-Cold War.
इकाई–3	गुटनिरपेक्षता की संकल्पना : आधार, भूमिका और प्रासंगिकता, क्षेत्रीय सहयोग : दक्षेस, आसियान, ओपेक, ओएएस, निशस्त्रीकरण और शस्त्र नियंत्रण : सी.टी.बी.टी., एन.पी.टी., पी.एन.ई., शीत युद्ध और नए दितान्त का आरम्भ, शीत युद्ध का अंत, शीत युद्ध के बाद के समकालीन राजनीतिक मुद्दे ।
Unit -4	North-South Dialogue and South- South Dialogue and their major issues. Globalization: Meaning, Nature, its advantages and disadvantages, role of the WTO. Liberalization and changing Nature of State.
इकाई–4	उत्तर –दक्षिण संवाद, दक्षिण–दक्षिण संवाद और उसके प्रमुख मुद्दे। भूमंडलीकरण : अर्थ, प्रकृति उसके लाभ हानि, विश्व व्यापार संगठन (WTO) की भूमिका, उदारीकरण और राज्य की परिवर्तित प्रकृति।
Unit-5	Environmental Issues: Rio-Declaration 1992 and Rio-Bio Diversity Agreement. Terrorism: Factors which give rise to terrorism, Terrorism in South Asia, Cross-Border Terrorism.
इकाई–5	पर्यावरणीय मुद्दे : रियो–घोषणा 1992 और रियो –जैव विविधता समझौता। आतंकवाद –कारण, दक्षिण एशिया में आतंकवाद, सीमा–पार आतंकवाद।

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M.A. I Year एम.ए.प्रथम वर्ष			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	IV चतुर्थ		
Title of the paper प्रश्नपत्र का शीर्षक	Major Ideas and Issues in Public Administration लोक प्रशासन के प्रमुख विचार एवं मुद्दे		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Meaning, Nature and Scope of Public Administration. Evolution of Public Administration as a discipline. New Public Administration. Impact of Information and Technology on Administration.
इकाई–1	लोक प्रशासन का अर्थ प्रकृति और क्षेत्र। लोक प्रशासन का विकास एक अनुशासन के रूप में। नव लोक प्रशासन। प्रशासन पर सूचना प्रौद्योगिकी का प्रभाव।
Unit-2	Decision Making Approach of Herbert Simon, Developmental Administration Approach, Ecological Approach- Fred Riggs Model. Scientific Management Theory- Taylor.
इकाई–2	हरबर्ट साइमन का निर्णय निर्माण उपागम, विकासात्मक प्रशासन उपागम, पारिस्थितिकी उपागम– फ्रेड रिग्स मॉडल। वैज्ञानिक प्रबंधन का सिद्धांत : टेलर।
UNit-3	Liberal Democratic Approach. Marxist Leninist Approach, Welfare State Approach.
इकाई–3	उदार लोकतांत्रिक उपागम, मार्क्सवादी लेनिनवादी उपागम, कल्याणकारी राज्य उपागम ।
Unit -4	Financial Administration- Importance and Aims, Zero Base Budgeting and Performance Budgeting- Process, Problems and Importance. Political and Administrative interaction in Economic Development. Impact of Economic Liberalization and Globalization on Administration.
इकाई–4	वित्तीय प्रशासन –महत्व और उद्देश्य। शून्य आधारित बजट और निष्पादन बजट– प्रक्रिया, समस्या और महत्व। आर्थिक विकास में राजनीतिक और प्रशासनिक संवाद। प्रशासन पर आर्थिक उदारीकरण और वैश्वीकरण का प्रभाव।
Unit-5	Neutrality of Civil Services, Downsizing of Bureaucracy. Modernization of Bureaucracy, Administrative Management.
इकाई–5	सिविल सेवा की तटस्थता, नौकरशाही के आकार में कमी। नौकरशाही का आधुनिकीकरण, प्रशासनिक प्रबंध।

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M.A. II Semester एम.ए. द्वितीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	I प्रथम		
Title of the paper प्रश्नपत्र का शीर्षक	Western Political Thought पाश्चात्य राजनीतिक चिंतन		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Political Thought of Plato , Political Thought of Aristotle
इकाई–1	प्लेटो के राजनीतिक विचार, अरस्तू के राजनीतिक विचार
Unit-2	Medieval Political Thought : St. Thomas Aquinas, Marsilio of Padua Machiavelli, Hobbes, Locke, Rousseau, Montesquieu.
इकाई–2	मध्यकालीन राजनीतिक विचार : संत थॉमस एक्विनास, मार्सिलियो ऑफ पेडुआ, मैकियावली, हॉब्स, लॉक, रूसो, माण्टेस्क्यू
Unit -3	Bentham, J.S. Mill, Hegel, Green.
इकाई–3	बेन्थम, जे. एस. मिल, हीगल, ग्रीन।
Unit -4	Marx, Lenin, Mao-Tse-Tung , New-Leftism.
इकाई–4	मार्क्स, लेनिन, माओ–त्से–तुंग, नव वामवाद
Unit-5	Rawls, Nozic and Communitarians Zio Pal Satra
इकाई–5	रॉल्स, नोज़िक और समुदायवादी जियो पाल सात्र

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M.A. II Semester एम.ए. द्वितीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	II द्वितीय		
Title of the paper प्रश्नपत्र का शीर्षक	State Politics in India भारत में राज्यों की राजनीति		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	State Executive: Governor, Chief Minister and Council of Ministers
इकाई–1	राज्य कार्यपालिका : राज्यपाल, मुख्यमंत्री और मंत्रिपरिषद्
Unit-2	State Legislature: Vidhan Sabha, Vidhan Parishad
इकाई–2	राज्य विधायिका : विधान सभा, विधान परिषद्
Unit -3	Judiciary: High Court and Subordinate Courts
इकाई–3	न्यायपालिका : उच्च न्यायालय और अधीनस्थ न्यायालय
Unit -4	Problem Areas: Increasing Demand for State Autonomy, Demand for the creation of New States, State Politics in the era of Globalization and Coalition politics, Interstate River water Disputes, Factors influencing State Politics in India.
इकाई–4	समस्याओं कें क्षेत्रः राज्य स्वायत्ता के लिए बढती मांग, नए राज्यों के निर्माण की मांग, वैश्वीकरण और साझा राजनीति के दौर में राज्यों की राजनीति, अंर्तराज्यीय नदी –जल विवाद, भारत में राज्य राजनीति को प्रभावित करने वाले तत्व।
Unit-5	Inter- State Council, State Planning Commission, State Finance Commission, State Election Commission, Broad Patterns of State Politics in India.
इकाई–5	अंर्तराज्यीय परिषद, राज्य योजना आयोग, राज्य वित आयोग, राज्य चुनाव आयोग, भारत में राज्यों की राजनीति की वृहद प्रवृत्तियां।

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M.A. II Semester एम.ए. द्वितीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	International Organization अंतर्राष्ट्रीय संगठन		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Nature and Evolution of International Organisation. The League of Nations: Role in protecting world peace. Causes of failure of League of Nations.
इकाई–1	अंतर्राष्ट्रीय संगठन की प्रकृति और विकास राष्ट्रसंघ : विश्वशांति की रक्षा में भूमिका, राष्ट्रसंघ के पतन के कारण
Unit-2	The United Nations: Structure and Functions, Various organs of the UN, need of reforms in the UN structure.
इकाई–2	संयुक्त राष्ट्र : संगठन और कार्य, संयुक्त राष्ट्र के विभिन्न अंग, संयुक्त राष्ट्र संगठन में सुधार की आवश्यकता।
Unit -3	Pacific Settlement and Forceful Settlement of International Disputes and Enforcement Action. Economic and Social Development and the Role of the UN.
इकाई–3	अंतर्राष्ट्रीय विवाद का शांतिपूर्ण समाधान और बाध्यकारी समाधान और प्रवर्तन कार्यवाही। आर्थिक और सामाजिक विकास और संयुक्त राष्ट्र की भूमिका।
Unit -4	UN in the Post Cold War Era, Socio Economic and Humanitarian role. UN as Peace Keeper & Politics within UN.
इकाई–4	शीतयुद्धोत्तर काल में संयुक्त राष्ट्र, सामाजिक आर्थिक और मानवीय भूमिका । शांति संवाहक के रूप में संयुक्त राष्ट्र और संयुक्त राष्ट्र में राजनीति।
Unit-5	UN's role in Disarmament. Contribution of Third worlds to Achieve goal of U.N.
इकाई–5	निशस्त्रीकरण में संयुक्त राष्ट्र की भूमिका। संयुक्त राष्ट्र के लक्ष्य को प्राप्त करने में तृतीय विश्व का योगदान।

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M.A. II Semester एम.ए. द्वितीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	IV चतुर्थ		
Title of the paper प्रश्नपत्र का शीर्षक	Research Methodology शोध पद्धति		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Nature of Social Research: Importance and uses, Difference between Pure and Applied Research, Identification of Research Problem, Research Design.
इकाई–1	सामाजिक शोध की प्रकृति : महत्व और उपयोग, विशुद्ध और व्यवहारिक शोध के मध्य अंतर, शोध समस्या की पहचान, शोध प्रारूप।
Unit-2	Hypothesis, Concepts and Variables, Typologies, Hypotheses Formulation and Testing, Sampling Method.
इकाई–2	प्राक्कल्पना, अवधारणा और चर, प्रकार, प्राकल्पना निर्माण और परीक्षण, निदर्शन विधि
Unit -3	Tools and Techniques of Data Collection, Observation: Characteristics of observation, Kinds of observation, merits and Demerits. Questionnaire, Scheduled and Interviews, Sampling and Survey technique.
इकाई–3	तथ्य संग्रहण के उपकरण और तकनीक, अवलोकन : अवलोकन की विशेषताएं, अवलोकन के प्रकार, गुण और दोष। प्रश्नावली, अनुसूची और साक्षात्कार, निर्दशन और सर्वेक्षण तकनीक।
Unit -4	Nature of study: Case study, technique, Role and importance of case studies, Pilot studies and panel studies
इकाई–4	अध्ययन की प्रकृति :वैयक्तिक अध्ययन, तकनीक, वैयक्तिक अध्ययन की भूमिका और महत्व पायलट स्टडी और पैनल स्टडी
Unit-5	Theory Formation in Social Sciences , Survey Analysis, Types, Merits, Demerits, Report writing, Purpose and contents of a Report, Style of Referencing & Plagiarism
इकाई–5	समाजिक विज्ञान में सिद्धांत निर्माण, सर्वेक्षण विश्लेषण, प्रकार, गुण दोष प्रतिवेदन लेखन, प्रतिवेदन का उद्देश्य और विषय वस्तु , ।

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	I प्रथम		
Title of the paper प्रश्नपत्र का शीर्षक	International Law अंतर्राष्ट्रीय कानून		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Origin and Development of International Law. Meaning, Nature, Scope and Sources of International Law.
इकाई–1	अंतर्राष्ट्रीय कानून की उत्पत्ति और विकास, अंतर्राष्ट्रीय कानून का अर्थ, प्रकृति, क्षेत्र और स्रोत।
Unit-2	Relationship Between International Law and National Law. Codification and Progressive Development of International Law.
इकाई–2	अंतर्राष्ट्रीय कानून और राष्ट्रीय कानून में संबंध, संहिताकरण और अंतर्राष्ट्रीय कानून का प्रगतिशील विकास।
Unit-3	International Legal Principles: Recognition, Equality, Law of Sea, Diplomatic Immunities and Privileges, Extradition.
इकाई–3	अंतर्राष्ट्रीय कानूनी सिद्धांत : मान्यता, समानता, समुद्री कानून, राजनयिक उन्मुक्तियां और विशेषाधिकार, प्रत्यर्पण।
Unit -4	Law of Neutrality, Rights and Duties of Neutral Powers, Violations of Neutrality
इकाई–4	तटस्थता का नियम, तटस्थ भाक्तियों के अधिकार और कर्त्तव्य, तटस्थता का उल्लंघन।
Unit-5	Laws of Air, Land and Sea Warfare, Treatment of Prisoners of War, 1949 Geneva Convention.
इकाई–5	हवाई नियम : भूमि और समुद्री युद्ध , युद्ध बंदियों के साथ व्यवहार, 1949 जेनेवा सम्मेलन।

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	II द्वितीय		
Title of the paper प्रश्नपत्र का शीर्षक	Indian Foriegn Policy भारतीय विदेश नीति		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Foreign Policy: Meaning, Nature and Determinants, Determinants of Indian foreign policy: Internal and External, Principles and Objectives of Indian Foreign Policy.
इकाई–1	विदेश नीति : अर्थ, प्रकृति और निर्धारक तत्व, भारत की विदेश नीति के निर्धारक तत्व : आंतरिक और बाहरी, भारत की विदेश नीति के सिद्धांत और उद्देश्य।
Unit-2	India and the USA, India and Russia, India and China
इकाई–2	भारत और संयुक्त राज्य अमेरिका, भारत और रूस, भारत और चीन।
Unit-3	India and Pakistan, India and Bangladesh, India and Srilanka
इकाई–3	भारत और पाकिस्तान, भारत और बांग्लादेश, भारत और श्रीलंका ।
Unit -4	India and Nepal, India and Bhutan, SAARC and India
इकाई–4	भारत और नेपाल, भारत और भूटान, दक्षेस और भारत।
Unit-5	India and The UNO, India and Nuclear Disarmament, Challenges before Indian Foreign Policy in 21st Century.
इकाई–5	भारत और संयुक्त राष्ट्र संघ, भारत और परमाणु निशस्त्रीकरण, 21वीं सदी में भारतीय विदेश नीति के समक्ष चुनौतियां।

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Comparative Politics तुलनात्मक राजनीति		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Comparative Politics: Meaning, Nature and Scope. Comparative Politics: Evol ution. Comparative Politics: Traditional and Modern Perspectives. Comparative Politics- Behavioral Frame Work.
इकाई–1	तुलनात्मक राजनीति : अर्थ, प्रकृति और क्षेत्र। तुलनात्मक राजनीति : विकास। तुलनात्मक राजनीति : परम्परागत और आधुनिक परिप्रेक्ष्य। तुलनात्मक राजनीति : व्यावहारवादी रूपरेखा।
Unit-2	Political System Approach and Analysis (David Easton), Structural Functional Approach and Analysis (G.A. Almond and G.B. Powell)
इकाई–2	राजनीतिक व्यवस्था उपागम और विश्लेषण डेविड ईस्टन, संरचनात्मक प्रकार्यात्मक उपागम और विश्लेषण जी. ए. आमण्ड और जी.बी. पावेल
Unit -3	Political Development Approach and Analysis (Views of Lucian Pie, Huntington, Almond and Organsi), Political Modernization, Political Culture.
इकाई–3	राजनीतिक विकास उपागम और विश्लेषण लुसियन पाई, हंटिग्टन, आमण्ड और आर्गेन्सी, राजनीतिक आधुनिकीकरण, राजनीतिक संस्कृति
Unit -4	Marxian Approach to Political Analysis, Critical Evaluation of Marxist Approach and Behavioral Approach vs. Gandhian Approach
इकाई–4	राजनीतिक विश्लेषण का मार्क्सवादी उपागम, मार्क्सवादी उपागम और व्यवहारवादी उपागम का आलोचनात्मक परीक्षण बनाम गांधीवादी उपागम।
Unit-5	Political Ethics (Views of Pareto, Mosca, Miachels, Laswell). Political Socialization (Views of Apter, Almond, Powell) Political Participation and Political Recruitment (Views of Apter, Almond, Powell). Political Communication (Views of Norbert Wiener and Karl W. Deutsch)
इकाई–5	राजनीतिक नैतिकता परेटो, मोस्का, माईकल, लॉसवेल के विचार राजनीतिक समाजीकरण एप्टर, आमण्ड, पावेल के विचार राजनीतिक सहभागिता और राजनीतिक भर्ती एप्टर, आमण्ड, पावेल के विचार राजनीतिक संचार नार्बट वीनर, कार्ल डब्ल्यू ड्यूच

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Local Government स्थानीय सरकार		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Nature, Scope and Importance of Local Administrations, Evolution of Local Government in Independent India, Balwant Roy Mehta and Ashok Mehta Committee Reports, 73rd and 74th Amendment Acts Recommendations.
इकाई–1	स्थानीय प्रशासन की प्रकृति, क्षेत्र और महत्व, स्वतंत्र भारत में स्थानीय सरकार का विकास, बलवंत राय मेहता और अशोक मेहता समिति का प्रतिवेदन, 73वें और 74वें संशोधन अधिनियम की अनुशंसाएं।
Unit-2	Organization, Structure and Functions of Rural Local Government. Village Panchayat, Panchayat Samiti, Zila Parishad, Local Finance.
इकाई–2	ग्रामीण स्थानीय सरकार का संगठन, ढांचा और कार्य। ग्रामीण पंचायत, पंचायत समिति, जिला परिषद्, स्थानीय वित्त।
Unit-3	Organization, Structure and Functions of Urban Local Government. Municipal Corporation, Municipality, Town Panchayat, Township, Cantonment, Notified Area Committee.
इकाई–3	भाहरी स्थानीय सरकार का संगठन, ढांचा और कार्य। नगरनिगम, नगर पालिका, नगर पंचायत, टाउनशिप, छावनी क्षेत्र, अधिसूचित क्षेत्र समिति।
Unit -4	Rural and Urban Development Programmes, Community Development Programmes, Employment and Poverty Alleviation Programmes, Urban Development Schemes, Housing, Water Supply and Sanitation Schemes.
इकाई–4	ग्रामीण और शहरी विकास कार्यक्रम, सामुदायिक विकास कार्यक्रम, रोजगार और गरीबी उन्मूलन कार्यक्रम, शहरी विकास योजनाएं, गृह निर्माण, जल प्रदाय और स्वच्छता योजनाएं।
Unit-5	Role of District Collector in Local Government Administration. Role of DRDA, Control and Supervision over Local Bodies, State and District.
इकाई–5	स्थानीय प्रशासन में जिलाधीश की भूमिका, जिला ग्रामीण विकास अभिकरण। राज्य और जिले का स्थानीय निकायों पर नियंत्रण एवं पर्यवेक्षण

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Women and Political Participation महिलाएं और राजनीतिक सहभागिता		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Women's Studies: Evolution, Nature, Scope and significance. Women's Studies and Political Science: Interrelationship.
इकाई–1	महिला अध्ययन : विकास, प्रकृति, क्षेत्र और महत्व। महिला अध्ययन और राजनीति विज्ञान : अंर्तसंबंध।
Unit-2	Theoretical Perspectives: 1. Individualist Feminism 2. Socialist Feminism 3. Radical Feminism
इकाई–2	सैद्धांतिक परिप्रेक्ष्य 1.वैयक्तिक नारीवाद 2. सामाजिक नारीवाद 3. उग्र नारीवाद
Unit -3	Status of Women and Determinants 1. Status of Women: Low Sex Ratio; Gender Development Index; Gender Empowerment Measurement. 2. Socio – Economic Determinants of Women's Status 3. Political Determinants: Constitution and Laws; Plans and Policies; Programmes and Administrative institutions
इकाई–3	महिला की स्थिति एवं निर्धारक तत्व 1. महिलाओं की स्थिति : कम लिंगानुपात, लैंगिक विकास सूचकांक, लैंगिक सशक्तिकरण मापक 2.. महिलाओं की स्थिति के सामाजिक– आर्थिक निर्धारक तत्व 3. राजीनतिक निर्धारक तत्व : संविधान और कानून, योजना और नीतियां, कार्यक्रम और प्रशासकीय संस्थाएं
Unit -4	Women and Political Process 1. Women and Political Parties, Organizations and Leadership 2. Women in electoral process: Voting behaviour; problems in representation 3. Reservation in Local self govt.; the reservation debate.
इकाई–4	महिलाएं और राजनीतिक प्रक्रिया 1.महिलाएं और राजनीतिक दल, संगठन और नेतृत्व 2.निर्वाचन प्रक्रिया में महिलाएं : मतदान व्यवहार, प्रतिनिधित्व में समस्याएं 3.स्थानीय स्वशासन में आरक्षण , आरक्षण वाद विवाद

Unit-5	**Women's Movement:** 1. Women's Role in Social Reform and Nationalist Movements 2. Episodes and Issues in Women's Movement in Independent India. 3. International Women's Movement: ILO and UNO on women's issues; Beijing Declaration and Platform of Action.
इकाई–5	महिला आंदोलन 1.सामाजिक सुधार और राष्ट्रीय आंदोलन में महिलाओं की भूमिका 2. स्वतंत्र भारत में महिला आंदोलन के प्रकरण और मुद्दे 3.अंतर्राष्ट्रीय महिला आंदोलन : महिलाओं के मुद्दों पर अंतर्राष्ट्रीय श्रम संघ और संयुक्त राष्ट्रसंघ, बीजिंग घोषणा और कार्यवाही का मंच

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	IV चतुर्थ		
Title of the paper प्रश्नपत्र का शीर्षक	Citizen and Civic Awareness		
	Open Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit-1	Need for Political Education- Citizen Obligation under Indian Constitution, Citizenship training, Political Culture.
इकाई–1	राजनीतिक शिक्षा के लिए आवश्यक – भारतीय संविधान के तहत नागरिक दायित्व, नागरिकता प्रशिक्षण, राजनीतिक संस्कृति ।
Unit-2	Procedural Aspects of Political Goods and Services and their delivery: Welfare Programmes, Applying for Ration Card, Birth and Death Certificates, Voter Registration, Voter Identity Card, PAN Card, Enrolling Membership for Central and State Government Programme, Employment Registration, A Critical Appraisal of the State of Political Goods & Services and their delivery. Consumer Forum and its uses for citizens, Redressing of Citizen Grievances.
इकाई–2	राजनीतिक वस्तुओं और सेवाओं के वितरण का प्रक्रियात्मक पक्ष : कल्याणकारी कार्यक्रम, राशन कार्ड के लिए आवेदन, जन्म और मृत्यु प्रमाण पत्र, मतदाता पंजीकरण, मतदाता पहचान पत्र, पेन कार्ड, केन्द्र और राज्य सरकार के कार्यक्रम के लिए सदस्यता नामांकन, रोजगार पंजीयन, राजनीतिक वस्तुओं और सेवाओं एवं उनके वितरण का आलोचनात्मक मूल्यांकन। नागरिकों के लिये उपभोक्ता मंच और उसका उपयोग, नागरिक शिकायतों का निवारण।
Unit-3	Citizens Charter- Meaning and Origin, Need for Citizen Charter: E- Governance, Delivery of Services.
इकाई–3	नागरिक चार्टर – अर्थ और उत्पत्ति, नागरिक चार्टर के लिए आवश्यक : ई–प्रशासन, सेवाओं का वितरण।
Unit -4	Meaning, Significance, Dimensions, Organization and Functions of NGO, Regulatory Mechanism at Central and State level Government over NGOs, Sources of Finances of NGOs, Expenditure, Account and Audit of NGOs, Self Help Group and Women Empowerment.p
इकाई–4	एनजीओ का अर्थ, महत्व, आयाम, संगठन और कार्य, एनजीओ पर केन्द्रीय और राज्य स्तरीय सरकार नियामक तंत्र, एनजीओ के वित्तिय स्रोत, खर्च, एनजीओ का लेखा और लेखा परीक्षण, स्व सहायता समूह और महिला सशक्तिकरण।
Unit5	Right to Information Act 2005. Right to Education and Employment–MGNREGA–Entrepreneurship.
इकाई–5	सूचना का अधिकार अधिनियम 2005, रोजगार और शिक्षा का अधिकार –मनरेगा– उद्यमिता।

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M.A. III Semester एम.ए.तृतीय सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	IV चतुर्थ		
Title of the paper प्रश्नपत्र का शीर्षक	Political Economy in India		
	Open Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	The relation between Politics and Economics; Contending Approaches towards Political Economy. Colonialism and its Consequences: Impact of British rule on Indian Economy. Underdevelopment and its Origin: Features of Underdevelopment in India. Meaning of and Approaches towards Poverty: Nature of Poverty in India: Poverty Alleviation Programmes in Rural India and their impact.
इकाई–1	राजनीति और अर्थशास्त्र के मध्य संबंध। राजनीतिक अर्थव्यवस्था के प्रति दृष्टिकोण, उपनिवेशवाद एवं उसके परिणाम : भारतीय अर्थव्यवस्था पर ब्रिटिश शासन का प्रभाव। अविकसितता और उसकी उत्पत्ति : भारत में अविकसितता की विशेषताएं। अर्थ और गरीबी के प्रति दृष्टिकोणः भारत में गरीबी की प्रकृति : ग्रामीण भारत में गरीबी उन्मूलन कार्यक्रम और उसका प्रभाव।
Unit-2	Planning in India: Goals of Indian Planning, Recent trends: Planning for Market Economy. Planning and Industrial Development: Industrial Policies since Independence, New Industrial Policy and Structural Adjustments. Liberalisation and Economic Reforms: Nature, Dimensions and. Class basis of Liberalisation
इकाई–2	भारत में नियोजन : भारतीय नियोजन के लक्ष्य, नई प्रवृत्तियां : बाजार अर्थव्यवस्था के लिये नियोजन। ओद्यौगिक विकास और नियोजन : स्वतंत्रता के बाद से ओद्यौगिक नीतियां, नई ओद्यौगिक नीति और संरचनात्मक समायोजन। उदारीकरण और आर्थिक सुधार : प्रकृति, आयाम और उदारीकरण का वर्गगत आधार।
Unit -3	Problems of Indian Agriculture, The Issue of Uneven Development of Agriculture. Agricultural Policies of Government of India and the Strategy of Development, their consequences. Problems of Land Reforms in India, Policies and Limitations.
इकाई–3	भारतीय कृषि की समस्याएं, कृषि के अनियमित विकास के मुद्दे। भारत सरकार की कृषि नीतियां और विकास की रणनीति, उसके परिणाम। भारत मे भूमि सुधार की समस्याएं, नीतियां और सीमाएं।
Unit -4	Legacies of the Colonial State, State as an instrument of Social Reform and Economic Development; Welfare State vs. Soft state.

	The debate over Nature of State in India: Various interpretations.
इकाई–4	औपनिवेशिक राज्य की विरासत, राज्य सामाजिक सुधार और आर्थिक विकास के साधन के रूप में, कल्याणकारी राज्य बनाम सॉफ्ट स्टेट। भारत में राज्य की प्रकृति पर बहस : विभिन्न व्याख्याएं।
Unit-5	Dominant Proprietary Classes in India: nature of Dominant Coalition. Role of Capitalist Class in India: Capitalist Class and National movement, Capitalist Class after independence. The Rich Farmers Class: Its growth, character and role in Indian Politics. Indian Social formation: Class vs. Caste.
इकाई–5	भारत में प्रमुख स्वामित्व वाले वर्ग : प्रमुख गठबंधन की प्रकृति। भारत में पूंजीपति वर्ग की भूमिका : पूंजीपति वर्ग और राष्ट्रीय आंदोलन, स्वतंत्रता के बाद पूंजीपति वर्ग। संपन्न कृषक वर्ग : विकास, स्वरूप और भारतीय राजनीति में भूमिका। भारतीय सामाजिक रचना : वर्ग बनाम जाति।

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	I प्रथम		
Title of the paper प्रश्नपत्र का शीर्षक	Political Sociology राजनीतिक समाजशास्त्र		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Political Sociology : Meaning, nature and Scope Approaches : Systems, Marxist and Developmental
इकाई–1	राजनीतिक समाजशास्त्र : अर्थ, प्रकृति और क्षेत्र उपागम : व्यवस्था, मार्क्सवादी और विकासवादी
Unit-2	Bureaucracy – Meaning & Nature, Weber‘s Contribution Power, Authority, Legitimacy, Social Stratification
इकाई–2	नौकरशाही – अर्थ और प्रकृति, वेबर का योगदान शक्ति, सत्ता, वैधता, सामाजिक स्तरीकरण
Unit -3	Elite: Theories of Circulation of Elites- Mosca, Pareto, C.Wright Mills; Pluralistic Critique
इकाई–3	अभिजन : अभिजन के प्रसार के सिद्धान्त– मोस्का, परेटो, सी. राइट मिल्स बहुलवादी आलोचना
Unit -4	Political Culture – Meaning, Nature and Types Political Socialization – Meaning, Nature, Process
इकाई–4	राजनीतिक संस्कृति – अर्थ, प्रकृति और प्रकार राजनीतिक समाजीकरण – अर्थ, प्रकृति, प्रक्रिया
Unit-5	Change and Development: Westernization, modernization and underdevelopment Political Participation: Political Parties, interest groups, Political Mobilization and Mass Media
इकाई–5	परिवर्तन और विकास : पाश्चात्यीकरण, आधुनिकीकरण और अल्पविकास राजनीतिक सहभागिता : राजनीतिक दल, हित समूह, राजनीतिक समूहीकरण और संचार मीडिया

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	II द्वितीय		
Title of the paper प्रश्नपत्र का शीर्षक	Government and Politics of Madhya Pradesh म.प्र.शासन और राजनीति		
	Core		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Reorganization of States (1956) and Formation of Madhya Pradesh. Division of Madhya Pradesh. Determinants and Characteristics of Madhya Pradesh Politics. Party System and Main Political Parties in Madhya Pradesh.
इकाई–1	राज्यो का पुनर्गठन (1956) तथा मध्य प्रदेश का निर्माण । मध्य प्रदेश का विभाजन। मध्य प्रदेश की राजनीति के निर्धारक तत्व एवं विशेषताएं, मध्य प्रदेश की दलीय व्यवस्था एवं प्रमुख राजनीतिक दल।
Unit-2	Governor: Powers, Position and Role. Chief Minister and Council of Ministers: Powers, Position and Role. State Legislative Assembly: Organization and Powers. High Court in Madhya Pradesh: Jurisdiction and Role.
इकाई–2	राज्यपाल : शक्ति, स्थिति एवं भूमिका। मुख्यमंत्री एवं मंत्रि परिषद् –शक्ति, स्थिति एवं भूमिका। राज्य विधानसभा : सगठन एवं शक्ति। मध्यप्रदेश में उच्च न्यायालय : क्षेत्राधिकार एवं भूमिका।
Unit -3	Administration in Madhya Pradesh: Structure, Secretariat, Chief Secretary, Secretary, Commissioner. District Administration in Madhya Pradesh : Role of Collector.
इकाई–3	मध्य प्रदेश में प्रशासन : संरचना सचिवालय,मुख्यसचिव, सचिव, आयुक्त । मध्य प्रदेश में जिला प्रशासन : जिलाधीश की भूमिका ।
Unit -4	Rural Local Self-Government in Madhya Pradesh : Organisation & Powers. Urban Local Self-Government in Madhya Pradesh : Organisation & Powers. Importance of Finance, Bureaucracy and Autonomy in Local Self-Government.
इकाई–4	मध्यप्रदेश में ग्रामीण स्थानीय स्वशासन : संगठन एवं शक्तियां। मध्यप्रदेश में नगरीय स्थानीय स्वशासन संगठन एवं शक्तियां। वित्त का महत्व, स्थानीय स्वशासन में नौकरशाही एवं स्वायत्तता।
Unit-5	Emerging Trends in Madhya Pradesh Politics : Politics of Tribals, Politics of Dalits, Naxalite Problem, Women and Politics. Electoral Politics and Voting Behaviour. Development Politics in Madhya Pradesh.
इकाई–5	मध्य प्रदेश की राजनीति में उभरती प्रवत्तियॉ : जनजातीय राजनीति, दलित राजनीति, नक्सल समस्या ,महिलाएँ और राजनीति । निर्वाचन की राजनीति एवं मतदान व्यवहार। मध्यप्रदेश में विकास की राजनीति ।

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Political Leadership राजनीतिक नेतृत्व		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Study of Political Leadership- A Comparative Perspective: Classical and Elite Views. Psychological, Sociological and Political Approaches. Leadership- Types, Roles, Style, Personality Traits, Functions, Performance.
इकाई–1	राजनीतिक नेतृत्व का अध्ययन – तुलनात्मक परिप्रेक्ष्य : शास्त्रीय एवं अभिजन मत। मनोवैज्ञानिक, समाजशास्त्रीय और राजनीतिक उपागम। नेतृत्व – प्रकार, भूमिका, शैली, व्यक्तिगत लक्षण, कार्य, व्यवहार।
Unit-2	Issues and Problems of Recruitment and Situational Factors Issues and Problems of Socialization
इकाई–2	भर्ती के मुद्दे एवं समस्याएं और स्थितिजन्य तत्व। समाजीकरण के मुद्दे एवं समस्याएं ।
Unit -3	Typologies of Power and Decision Making and Executive Authority.
इकाई–3	निर्णय निर्माण और शक्ति के प्रकार एवं कार्यपालिकीय प्राधिकार ।
Unit -4	Political Leadership and Nation-Building in India: Local, Regional and National Levels. Conflict Generation & Conflict Resolution in Indian Politics
इकाई–4	भारत में राष्ट्र निर्माण और राजनीतिक नेतृत्व : स्थानीय, क्षेत्रीय और राष्ट्रीय स्तर। भारतीय राजनीति में संघर्ष निर्माण एवं संघर्ष समाधान
Unit-5	Role of Leadership & Emerging Challenges: Emerging patterns of leadership. Problems of autonomy: Financial & Administrative Spheres.
इकाई–5	नेतृत्व की भूमिका एवं उभरती चुनौतियां : नेतृत्व के उभरते आयाम। स्वायत्ता की समस्याएं : वित्तिय एवं प्रशासकीय स्थिति।

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Media and Politics मीडिया और राजनीति		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Theories of Political Communication: Concept, Role of Communication in a Democracy, Media as a means of Socialization
इकाई–1	राजनीतिक संचार के सिद्धांत : अवधारणा, लोकतंत्र में संचार की भूमिका, सामाजीकरण के साधन के रूप में मीडिया
Unit-2	Press and Politics in India- Critical Evaluations of Role and Impact, Election Campaigns, Opinion Polls, Exit Polls, Relevance and Reliability. Agenda Setting Function of the Media.
इकाई–2	भारत में प्रेस और राजनीति –भूमिका और प्रभाव का आलोचनात्मक परीक्षण, चुनाव प्रचार, जनमत सर्वेक्षण, निर्गम मतानुमान, प्रासंगिकता और विश्वसनीयता। मीडिया की कार्यावलि सेटिंग कार्य।
Unit -3	T.V., Radio and Politics in India- Critical Evaluation of role and Impact, Freedom of Media and Right to Information.
इकाई–3	भारत में टी.वी., रेडियो और राजनीति – भूमिका और प्रभाव का आलोचनात्मक परीक्षण, मीडिया की स्वतंत्रता और सूचना का अधिकार।
Unit -4	Mass Media and the Government- Issues and Problems Government Monopoly, Executive Censorship, Judicial Interpretation, Nation Building and Political Development in India
इकाई–4	संचार मीडिया और सरकार – मुद्दे और समस्याएं सरकारी एकाधिकार, कार्यपालकीय सेंसरशीप, न्यायिक व्याख्याएं, भारत में राष्ट्र निर्माण और राजनीतिक विकास
Unit-5	Media and Social Responsibility: Economic Pressures, Media reportage of marginalized sections- children, dalits, tribals, Gender, Media coverage of violence and related laws - inflammatory writing (IPC 353), Sedition-incitement to violence, hate Speech.
इकाई–5	मीडिया और सामाजिक उत्तरदायित्व : आर्थिक दबाव, हाशिये के वर्ग का मीडिया प्रतिवेदन – बच्चे, दलित, जनजाति, लिंग, हिसा और उससे संबंधित कानून का मीडिया कवरेज– इंफलेमेटरी (भड़काऊ) लेखन (IPC 353), देशद्रोह– हिंसा को प्रोत्साहन, घृणा भाषण

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	III तृतीय		
Title of the paper प्रश्नपत्र का शीर्षक	Electoral Politics in India भारत में चुनावी राजनीति		
	Core Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Electoral Politics in India- Pre and Post Independence: Nature Characteristics and Change
इकाई–1	स्वतंत्रता से पूर्व और पश्चात् भारत में चुनावी राजनीति – प्रकृति लक्षण और परिर्वतन
Unit-2	Election Commission of India: Power, Functions and Role Determinants of Voting Behavior- Role of Caste, Religion, Language, Region and Social and Economic Class.
इकाई–2	भारत का निर्वाचन आयोग : शक्ति, कार्य और भूमिका मतदान व्यवहार के निर्धारक तत्व – जाति, धर्म, भाषा, क्षेत्र और सामाजिक व आर्थिक वर्ग की भूमिका
Unit -3	Party system in India: Nature, Classification, Ideology and Programmes, Organization and Leadership.
इकाई–3	भारत में दल व्यवस्था : प्रकृति, वर्गीकरण, विचारधारा और कार्यक्रम, संगठन और नेतृत्व
Unit -4	Electoral Reforms: Tarkunde, Goswamy and Indrajeet Gupta Committee Reports Electoral Reforms by the Election Commission during, T.N. Seshan and Lingdoh Regime.
इकाई–4	चुनाव सुधार : तारकुण्डे, गोस्वामी और इंद्रजीत गुप्ता समिति प्रतिवेदन टी.एन.शेषन और लिंगदोह कार्यकाल के दौरान निर्वाचन आयोग द्वारा किए गए चुनाव सुधार
Unit-5	Anti- Defection Law: A Critical Study, Majoritarian Parliamentary System Vs. Representational Parliamentary System.
इकाई–5	दल बदल कानून : आलोचनात्मक अध्ययन, बहुमतवादी संसदीय व्यवस्था बनाम प्रतिनिध्यात्मक संसदीय व्यवस्था

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M.A. IV Semester एम.ए. चतुर्थ सेमेस्टर			
Subject विषय	Political Science राजनीति विज्ञान		
Paper प्रश्नपत्र	IV चतुर्थ		
Title of the paper प्रश्नपत्र का शीर्षक	Human Rights मानव अधिकार		
	Open Elective		
Max.Marks/अधिकतम अंक	Theory/सैद्धांतिक	Internal Assessment/आंतरिक मूल्यांकन	Credit
50	40	10	5

Unit -1	Human Rights: Meaning Concept and Historical Development . Rights: Meaning and Definition. Types of Rights: Moral and legal.
इकाई–1	मानव अधिकार : अर्थ, अवधारणा और एतिहासिक विकास । अधिकार : अर्थ और परिभाषा, अधिकारो के प्रकार : नैतिक और वैधानिक।
Unit-2	Theories of Rights: Theory of Natural Right. Liberal Theory, Legal Theory, Marxist Theory.
इकाई–2	अधिकार के सिद्धांत : प्राकृतिक अधिकार के सिद्धांत । उदारवादी सिद्धांत, वैधानिक सिद्धांत, मार्क्सवादी सिद्धांत।
Unit -3	Duties: Meaning, Definition and Types. Relationship between Rights and Duties.
इकाई–3	कर्तव्य : अर्थ, परिभाषा और प्रकार। अधिकार और कर्तव्य के बीच संबंध
Unit -4	Charter of United Nations, Universal Declaration of Human Rights1948, International Covenant on Economic, Social and Cultural Rights1966, International Covenant on Civil and Political Rights,
इकाई–4	संयुक्त राष्ट्र चार्टर, मानवाधिकार सार्वभौमिक घोषणापत्र 1948, आर्थिक, सामाजिक और सांस्कृतिक अधिकारो की अंतर्राष्ट्रीय संहिता 1966, नागरिक और राजनीतिक अधिकारो की अंतर्राष्ट्रीय संहिता
Unit-5	Human Rights in the context of India a)Human Rights and Constitutional Provisions; b) Human Rights and Judicial Activism; c) National Commission for Human Rights; d) National Minority Commission; e) National Women's Commission
इकाई–5	भारतीय संदर्भ में मानवाधिकार 1 मानवाधिकार और संवैधानिक प्रावधान 2. मानवाधिकार और न्यायिक सक्रियता 3 राष्ट्रीय मानवाधिकार आयोग 4 राष्ट्रीय अल्पसंख्यक आयोग 5 राष्ट्रीय महिला आयोग

SYLLABUS

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PHYSICS

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M.Sc. Physics: Program Specific Outcomes (PSO)

After undertaking a course of M.Sc. Physics, the learner shall be able to:-

No.	**Program Specific Outcomes**
PSO 1	To provide a thorough knowledge of the fundamental concepts in all of the main disciplines of physics. providing a well-defined study of theoretical and experimental physics.
PSO 2	Plan and carry out experiments that show a comprehension of scientific principles, procedures, and phenomena.
PSO 3	Recognize the value of approximation and mathematical techniques to represent the physical world, as well as the relevance of mathematical modeling, simulation, and computation.
PSO 4	Have a working knowledge of the analytical techniques needed to evaluate and analyze data and form conclusions. Apply conceptual understanding and critical thinking to general real-world situations
PSO 5	Equip the student to pursue research and development in any of the major areas of Physics. Communicate physics-related themes to society show casing the influence of science, particularly physics, on society.

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-I: Mathematical Physics

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	The Student will be able to learn different special functions/polynomials	U,R
CO-II	The Student will be able to understand the different Integral Transforms and their applications	U,Ap,An,C
CO-III	To enable students to define and construct Green Function and apply it to solve various problems	C,Ap,E
CO-IV	Student will be able to solve problems related to complex variables	U,E

CO- Course Objectives

Course Learning Outcome

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	The Learner will understand Special functions, such as Hermite, Legendre and Laguerre polynomials and Bessel functions	1,3	U
CLO-II	The Learner will use Fourier transform, inverse Fourier transform, Laplace transform, inverse Laplace transforms & their properties. They will make use of Laplace transform to solve physical problems	1,4,5	U, Ap ,An
CLO-III	The Learner will construct Green Function and apply it to solve non homogeneous differential equations	1,2,3	U, Ap, An ,C
CLO-IV	The Learner will recognize and use Complex numbers, their functions and properties. They will apply Residue theorem in evaluating definite integrals	1,3	R , U , Ap , E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit -I

Differential equations: Recursion relation, generating functions and orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials. Curvilinear co-ordinate system with specific cases of Cartesian, Cylindrical, and Spherical coordinate systems.

Unit -II

Integral transforms. Fourier integral. Fourier transform and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem. Elementary Laplace transforms. Laplace transform of derivatives. Application to a damped harmonic oscillator.

Unit -III

Green's functions: Non-homogenous boundary value problems, Green's function for one dimensional problems, eigen function expansion of Green's function, Fourier transform. Method of constructing Green's function, Green's function for electrostatic boundary value. Problems and quantum-mechanical scattering problem.

Unit -IV

Complex variables: Analyticity of complex functions. Cauchy Riemann equations. Cauchy theorem. Cauchy integral formula. Taylors, Maclaurin, Laurent series & mapping. Theorem of residues. Simple cases of contour integration. Jordan's lemma Integrals involving multiple valued functions(Branch points).

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

1. Green's function for a linear oscillator, Green's function and the Dirac δ-function, finding Green's function for Linear operators in 1-D.
2. Potential due to discrete or continuous charge distribution; vibration of a circular membrane, solving the 1-D harmonic oscillator Schrodinger equation; Relation of the hydrogen atom, Schrodinger equation with Laguerre equation and solution.
3. Solution of initial value problems by using Laplace transform; LT and inverse LT of various functions,
4. Solution of limit dept problems by Fourier transform; FT of Gaussian function, Application of FT of Dirac delta function.
5. Verification of analyticity of simple function, Evaluation of some definite integral using residues etc.
6. Evaluation of integrals in complex variables

Text and Reference Books

- Mathematical Methods for Physicists : G. Arfken
- Advanced Engineering Mathematical : E. Kreyszig
- Special functions : E.D. Rainville
- Special functions : W.W. Bell
- Mathematical Methods for Physicists and Engineers : K.F. Reily, M.P.Hobson and S.J. Bence
- Mathematics for Physicist : Mary L Boas

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-II: Classical Mechanics

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	The Student will be able to understand the necessity of Lagrangian and Hamiltonian formulations	U,R
CO-II	The Student will be introduced to forces, angular momentum and constraints	U,R
CO-III	The Student will be able to understand and apply variational principles to real physical problems	U,Ap,E,C
CO-IV	The Student will be able to understand and explain generating function, canonical transformation & Poisson brackets	U,An
CO-V	The Student will be able to understand forces in non-inertial systems	U

CO-Course Objectives

Course Learning Outcome

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will understand Newtonian, Lagrangian and Hamiltonian formulations of classical mechanics and apply in appropriate physical problems.	1,3	U, Ap
CLO-II	Learner will understand the equations of canonical transformation and generating functions. Poisson's brackets and its applications	4,5	U, R, E ,C
CLO-III	Learner will define and simplify the Small oscillation problems.	2,4	U, R, An

CLO-IV	Learner will understand and recapitulate the special theory of relativity and their postulates. Elaborate 4- vectors and 4 – scalars, Covariant Lagrangians and Hamiltonians	1,5	U , C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit - I

Newtonian mechanics of one and many particles systems: Conservation laws, Constrains their classification, Principle of virtual work; D'Almbert's principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almbert's principle, Generalized momenta and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem; the equation of motion and first integrals, the differential equation for the orbit.

Unit - II

The equations of canonical transformation and generating functions; The Hamilton- Jacobi Action and Angel variables. Poisson's brackets; simple algebraic properties of Poisson.s brackets. The equation of motion in Poisson's Brackets notation. Poisson theorem; principle of least action. The Kepler problem, Inverse central force field, Rutherford scattering.

Unit - III

Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Applications to coupled pendulum and linear bistable molecule. Rotating coordinate systems. Acceleration in rotating frames. Coriolis force and its terrestrial astronomical applications, Elementary treatment of Eulerian coordinates and transformation matrices. Angular momentum inertia tensor. Euler equations of motion for a rigid body. Torque free motion for a rigid body.

Unit - IV

Symmetries of space and time. Invariance under Galilian transformation, Covariant four dimensional formulation, 4 -Vectors and 4 - scalars. Relativistic generalization of Newton's laws, 4 - momentum and 4 - force, variance under Lorentz transformation relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Simple pendulum with rigid support. Two connected masses with string passing over

a pulley, virtual work.

(2) Various Poisson's brackets thin relation with PBs in quantum mechanics stability of orbits under central force' orbital elements of planetary orbits.

(3) Rotating frames, small oscillations in Linear triatomic molecule and coupled pendulum.

(4) 4-momentum and 4-force, Relativistic Kinetic energy, mass variation,

The problems given in this Text and preference books will form tutorial course.

TEXT AND REFERENCES BOOKS

Classical Mechanics	:	N. C. Rana and P.S. Jog (Tata Mc Graw Hill, 1991)
Classical Mechanics	:	H. Goldstein (Addision Wesley, 1980)
Mechanics	:	A Sommerfiels (Academi Press 1952)
Introduction to Dynamics	:	I. Perceival & Richards(CambridgeUniv.Press,1982)

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. I Semester **Max Marks- 40**

Passing Marks - 14

Paper-III: Digital Electronics & Electronic Devices

Course Objectives

The objectives of the course are:

	Course Objectives	Cognitive Level
CO-I	To introduce formulation of Boolean Functions and Digital Electronics	R,U,An,Ap
CO-II	To develop an understanding on operational amplifiers and their applications	U,Ap,C
CO-III	To share the knowledge of various semiconductor Field Effect Transistors and Microwave devices	E
CO-IV	To describe Photonic devices	U,Ap

CO-Course Objectives

Course Learning Outcome

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	The Learner will understand the Techniques of simplification of digital circuits	1,2	R,U,An
CLO-II	The Learner will understand Operational amplifiers and their use in various applications in various logic circuits.	3,4	U, Ap ,C
CLO-III	The Learner will understand and explain various Metal oxide semiconductors JFET, MOSFET, MESFET,	1,5	U, An
CLO-IV	The Learner will understand and apply Microwave devices such as Tunnel, IMPATT and Gunn Diodes.	1,5	R , U , E,Ap

CLO-V	The Learner will understand and recall Various Photonic devices and their I-V characteristic curve.	1,3	U,Ap,E
CLO-VI	Learner will understand and use Op-Amp, and compare I-V characteristic curves of FET, Tunnel Diode, LED etc.	1,2,3	U, An,C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit – I

Digital Electronics: Number systems (decimal, Binary, Octal, hexadecimal) and their conversion, Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR (Truth table, Boolean expression, symbol), diode and transistor as logic gate, laws of Boolean algebra, K-map, De Morgan's theorem.

Bistable Circuits: RS Flip-flop, clocked RS Flip flop, Edge trigger Flip flop, D Flip flop Preset and clear.

Unit – II

Operational Amplifiers: DC Amplifier, Difference amplifier, Op-Amp symbol, OP-AMP Parameters: Input bias current, Input offset current, Input offset voltage, Open loop gain, CMRR, Slew Rate, Concept of virtual ground, summing point, ideal Op-Amp.

Application of Op-Amp: Inverting and Non-Inverting modes of Op-Amp, Use of OPAMP as adder, subtractor, differentiator, integrator, IC 741 as Op-Amp.

Unit – III

Transistors: Junction Field Effect Transistor (JFET); Physical Structure, Principles of Operation, Metal Oxide Semiconductor Field Effect Transistor (MOSFET); Physical Structure, Electronics Mechanism, Mode of Operation, and Metal-Semiconductor Field-Effect-Transistors (MESFET); Physical Structure, Principles of Operation,derivations of the equations for I-V characteristics under different condition.

Microwave devices: Tunnel diode, Transfer electron devices (Gunn diode), Avalanche transits time devices, Impatt diodes and Parametric devices.

Unit - IV

Photonic devices: Radiative and non-radiative transitions, Photo Conductive Devices (LDR), Diode Photo Detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (structure, high frequency limit, Working, operation of LED, Applications), Diode lasers (Construction, Population Inversion, Optical Gain, Working and Application) .

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

1. Half adder and Full adder; its design, working, truth table.
2. JK Flip Flop and JKMS Flip Flop; its design, working, truth table.
3. Application of Op-Amp as a Function generator.
4. Application of Op-Amp as a Regenerative Comparator (Schmitt Trigger).
5. Design of MOSFET amplification in different configurations.
6. Microwave oscillators: Klystron and Magnetron.
7. Deviation of the condition of lasing action in a two level system, optical pumping.
8. Derivation of rate equation for three – Laval Devices system.

The problems given in this Text and preference books will form tutorial course.

Text and reference books:

1. Semi Conductor Devices – Physics and Technology : SM Sze (Wiley)

2. Introduction to Semiconductor devices : M.S. Tyagi (John Wiley and Sons)

3. Optical Electronics :AjoyGhatak and K. Thygarajan (Cambridge Univ. Press.).

4. Digital and Analogue Technique: G.N.Navneetha, V.M.Gokhale, R.G.Kale (Kitab Mahal)

5. Electronic Devices and Circuit Theory; Robert L. Boylestad, Louis Nashelsky (Pearson)

6. Microwave Devices and Circuits: Samuel Y. Liao (Pearson)

7. Electronic Devices and Circuit Theory; Louis Nashelsky and Robert Boylestad (Pearson Education).

8. Electronic Devices and Integrated Circuits: Singh, B. P., Singh, Rekha (Pearson Education).

9. Op-Amps and Linear Integrated Circuits: Ramakant A. Gayakwad (Prentice Hall)

Mode of Evaluation CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. I Semester **Max Marks- 40**
Passing Marks - 14

Paper-IV: Computational Methods and programming

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To introduce basics of "C" programming	U,R
CO-II	To Equip Students with the ability to solve systems of linear and non-linear equations	Ap,An,E
CO-III	To get familiar with matrix algebra, curve fitting and to calculate integrals and differentials using different numerical methods	C,E
CO-IV	To build a conceptual understanding of interpolation	U,C
CO-V	To get familiar with Computational methods for solving differential equations and introduction of random variables	U

CO-Course Objectives

Course Outcome

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	The student will understand various aspect of 'C' Programming.	1	U, Ap, C
CLO-II	The student will understand and Solve and determine zero of linear and non-linear equations using different methods.	2,3	U, R, Ap ,C, An
CLO-III	The student will understand and determine Eigen values and Eigen vectors of matrices using different methods.	2,4	U, Ap, An
CLO-IV	The student will understand and define Interpolation and various methods for interpolation.	3,4,5	R , U , Ap , E
CLO-V	The student will understand and evaluate	2,3,5	U, E

	numerical solutions of ordinary differential equation.		

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit – I

Introduction to C: Data type (int, float, double, char, long, long double etc.) operators (Unary.Binary and ternarys), input /output statement (scanf(), printf()), control statements (if, for, while, do while, switch -case-default), Function (type of Function, function definition, function calling, formal arguments, actual arguments, function prototype), Program structure, string (Array, character array), string manipulation functions like strlen(), strcpy(), strcat(), strcmp(), etc.

Unit – II

Method for determination of zeros: linear and non-linear algebraic equation and transcendental equations using bisection method, false position method and Newton Raphson method, convergence of solutions, solutions of simultaneous linear equation, Gaussian elimination method, pivoting, iterative method, Matrix inversion.

Unit – III

Eigen Value and Eigen Vectors of Matrices: Power and Jacobi method, finite difference interpolation with equally and unequally spread points, curve fitting, polynomial least squares and cubic spline fittings. Numerical differentiation and Integration, Newton-Cotes Formulae, error estimates, Gauss-Method.

Unit – IV

Interpolation: Lagrange's Interpolation, Finite difference and operators, Newton forward, Newton backward, Gauss forward, Gauss backward, Stirling's interpolation divided difference formula.

Unit –V

Numerical solution of ordinary differential equation : Euler and Runga-Kutta Methods, predicators and corrector method. Introduction to partial differential equations & their classification. Solution of Laplace Equation by Finite Difference Method. Random variables, Monte Carlo evaluation of integrals

Suggested Readings:

1. Introduction method of numerical analysis : Sastry
2. Numerical Analysis : Rajaraman

3. Programming with C : Gottfried
4. Programming with C : Balagururswamy
5. Numerical Analysis : Balaguruswamy

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.)
End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-I: Quantum Mechanics-I

Course Objective

The objectives of the course are:

NO.	Course Objective	Cognitive Level
CO-I	To give knowledge of basics of Quantum Mechanics	U,R
CO-II	To learn Schrodinger equation and their applications	U,Ap,An,E
CO-III	To understand the operator formulation of quantum mechanics	U,Ap
CO-IV	To study role of uncertainty in quantum physics	Ap,C
CO-V	To demonstrate the linear harmonic oscillator and hydrogen-like atom problems	An,E
CO-VI	To explain the angular momentum operators associated with spherical and symmetrical systems	U,R

CO-Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
COU-I	Learner will be able to familiar with quantum mechanics formulation.	1,5	R,U
COU-II	Learner will be able to interpret the wave function of quantum particle and its probabilistic nature.	2,3,4	R,U
COU-III	Learner will be able to understand Hilbert space, bra and ket notations, creation and annihilation operators, Schwartz inequality.	1,3,4	U, Ap, E
COU-IV	Learner will be able to model behavior of quantum particle encountering different	3,5	U , Ap , An

	potential conditions.		
COU-V	Learner will be able to formulate Eigen values and Eigen function of angular momentum operator	2,3	U,C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit - I

Basic Postulates of quantum Mechanics, equation of continuity, Normality, orthogonality and closure properties of eigen functions, expectation values and Ehrenfest theorems, solution of Schrödinger equation for one dimensional (a) potential well (b) potential step and (c) Potential barrier.

Unit - II

Linear vector space, concept of Hilbert space, bra and ket notation for state vector, representation of state vectors and dynamical variables by matrices and unitary transformation (Translation and rotation), creation and annihilation operators, matrices for x and p. Heisenberg uncertainty relation through operators (Schwartz inequality).

Unit -III

Solution of Schrödinger equation for (a) linear harmonic oscillator (b) hydrogen - like atom (c) square well potential and their respective application to atomic spectra, molecular spectra and low energy nuclear states (deuteron).

Unit - IV

Angular momentum in quantum mechanics, Eigen values and Eigen function of L_2 and L_z in term of spherical harmonics, commutation relation.

Identical particles with spin, symmetric and antisymmetric wave functions, Pauli's exclusion principle, Pauli's spin matrices, Slater determinant.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Plotting of Harmonic oscillator wave functions in 1-d.

(2) Energy levels of a particle of mass m moving in one-dimensional potential.

$$V(x) = \begin{cases} +\infty, & x < 0 \\ +\frac{1}{2} m\omega^2 x^2, & x > 0 \end{cases}$$

(3) Wave function corresponding to minimum uncertainty product. Gaussian wave packet. Spread of wave packet in time.

(4) Continuous basis corresponding to position eigen values and wave functions corresponding to state vectors using position and momentum representation.

(5) Rotational spectra of diatomic molecules.

(6) Vibrational and rotational spectra of diatomic molecules.

(7) Spin and statistics

Books Recommended

- L I Schiff, Quantum Mechanics
- S Gasiorovvicz, Quantum Physics
- B Craseman and J D Powell Quantum Mechanics
- A P Messiah Quantum Mechanics
- J. J. Sakurai Modern Quantum Mechanics
- Mathews and Venkatesan Quantum Mechanics

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments,etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur
Department of Physics
Under CBCS System

2023-24
M. Sc. II Semester **Max Marks- 40**
Passing Marks - 14

Paper-II: Statistical Mechanics
Course Objectives

The objectives of the course are:

NO	Course Objectives	Cognitive Level
CO-I	To recognize the link between thermodynamics with the micro description used in classical Statistical Mechanics. / to learn the properties of macroscopic systems using the knowledge of the properties of individual particles	U,R,Ap
CO-II	To get acquaint with Quantum Statistical Mechanics (Fermi-Dirac & Bose-Einstein statistics) & Fermi & Bose systems	U,Ap,An
CO-III	To develop a molecular-level understanding for transitions (as in magnetism) and to solve it using different (mean-field) approximations	Ap,C
CO-IV	To have an appreciation for the modern aspects of equilibrium and non-equilibrium statistical physics and to describe the behavior of such system that obeys detailed balance in presence of a random noise	E
CO-V	To describe the features and examples of Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics	U,R

CO- Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO -I	Learner will outline the basic concepts of statistical mechanics	1,5	U, R
CLO -II	Learner will classify and compare the combinational studies of particles with their distinguishably and indistinguishably. (Maxwell-Boltzmann, Bose-	2,3	U, Ap, An

	Einstein and Fermi-Dirac distribution laws)		
CLO - III	Learner will apply the Quantum statistical mechanics for Cluster Expansion	4,5	U, Ap, An
CLO - IV	Learner will develop a molecular-level understanding for transitions (as in magnetism) and to solve it using different (mean-field) approximations	2,3,4	U , C, Ap, E
CLO - V	Learner will imagine the importance of Non-equilibrium aspects in a physical system	3,5	U,C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit - I

Foundation of statistical mechanics, specification of states of a system contact between statistics and thermodynamics, classical ideal gas entropy of mixing and Gibb's paradox. Microcanonical ensemble, phase space, trajectories and density of states, Liouville theorem, canonical and grand canonical ensembles, partition function, calculation of statistical quantities, energy and density fluctuations.

Unit-II

Statistics of ensembles, statistics of indistinguishable particles, density matrix, Maxwell Boltzmann, Fermi Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose Einstein condensation, properties of ideal Fermi gas, electron gas in metals, Boltzman transport equation.

Unit-III

Cluster expansion for a classical gas, virial equation of state, mean field theory of Ising model in 3, 2 and 1 dimension. Exact solution in one-dimension.

Unit - IV

Thermodynamics fluctuation spatial correlation Brownian motion, Langevin theory, fluctuation dissipation theorem, the Fokker-Planck equation, Onsager reciprocity relations

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Calculation of number of states and density of states.

(2) Relative population of particles in two energy levels.

(3) Liquid helium II

(4) Electrical and thermal conductivities.

(5) Evaluation of virial coefficient

(6) Critical indices.

(7) Applications of Onsager relation

(8) Diffusion co-efficient

Books Recommended

- F Reif : Statistical and thermal Physics
- K Huang : Statistical Mechanics
- R K Pathria : Statistical Mechanics
- R Kubo : Statistical Mechanics
- Tandan : Statistical Physics

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur
Department of Physics
Under CBCS System
2023-24
M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-III: Electrodynamics & Plasma Physics

Course Objectives

The objectives of the course are:

No	Course Objectives	Cognitive Level
CO-I	To learn the effect of electric and magnetic fields in matter	U,R
CO-II	To learn various electromagnetic processes and meaning and the importance of Maxwell's equation	U,R,Ap
CO-III	Identify the processes of measurement of plasma parameters	An
CO-IV	To builds the knowledge of Relativity and introduces the formulation of relativity in 4-vector notation	C
CO-V	Student will be able to learn basic problem-solving in electrostatics using method of images	E
CO-VI	Student will be able to learn about plasma physics – electric oscillations, propagation and its production	U,C,E

CO- Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will outline the basics of electrostatics and magnetostatics, Maxwell's equations	1,5	U, R, Ap
CLO-II	Learner will understand the Four vector and Lorentz transformation in 4-dimensional spaces	3	U,C, An, R
CLO-III	Learner will simplify Langragian and Hamiltonian for a relativistic charged particle in External EM field	4,5	U, An, R, Ap
CLO-IV	Learner will create an Elementary concept of occurrence of plasma. Explain the Gaseous and solid state Plasma	2,5	U, C, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyze; E- Evaluate; C – Create

Unit - I

Review of Basics of electrostatics and magnetostatics, electric field, Gauss's law, Laplace and Poisson equations, method of images, Biot-Savart law, Ampere law, Maxwell's equations, scalar and vector potentials, gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, retarded potentials, Lienard-wiechert potentials, fields of charged particles in uniform motion, fields of arbitrarily moving charge particle.

Unit-II

Fields of an accelerated charged particles at low velocity and high velocity, angular distribution of power radiated, Review of four vector and Lorentz transformation in 4-dimensional spaces, Invariance of electric charge, relativistic transformation properties of E and H fields. Electromagnetic fields tensor in 4- dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics. Langragian and Hamiltonian for a relativistic charged particle jn External EM field; motion of charged particles in electromagnetic fields, uniform and nonuniform E and B fields.

Unit -III

Elementary concept of occurrence of plasma. Gaseous and solid state plasma. Production of gaseous and solid state plasma. Plasma parameters. Plasma confinement pinch effect instability in a pinched- plasma column. Electrical neutrality in a plasma. Debye screening distance. Plasma oscillations: Transverse oscillations and longitudinal oscillations.

Unit - IV

Domain of Magnetohydrodynamics and plasma Physics : Magnetohydrodynamic equations, magnetic hydro-static pressure hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, the theory of single and double probes.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Obtain the formal solution for electromagnetic boundary value problem with Green function.

(2) Discuss the problem of conducting sphere is a uniform electric field by method of images and Green's functions.

(3) For a solenoid wound with N turns per unit length and carrying a current I, show that the magnetic flux density on a point on the axis is given (for $N \to \infty$) by

$$B_z = \frac{2\pi NI}{C}(\cos\theta_1 + \cos\theta_2)$$

Where θ_1, θ_2 are the angles between the axis and the lines joining the point on the axis to the first and last turns of the solenoid.

(4) A linear accelerator accelerates protons to almost relativistic speeds. Determine fraction of power radiated by the protons to the power supplied in terms of the gradients of the linear electric field.

(5) A charged particle oscillated according to the harmonic law Determine the total average intensity of the emitted radiation.

(6) Discuss the Lagrangian and Hamiltonion for a relativistic charged particle in External electromagnetic field.

(7) Obtain the expression for energy radiated as Cherenkov radiation per unit distance along the path of the particle.

(8) Consider a magnetic field configuration that is cylindrically symmetric and a charged particle is injected into it. Use the adiabatic invariant of motion to describe conditions in which the injected particle would bounce back from the direction of increasing field gradient.

(9) Consider the problem of waves in an electronic plasma when an external magnetic field B_0 is present. Use the fluid model, neglecting the pressure term as well as collisions.

(a) Write down the linearized equations of motion and Maxwell equations, assuming all variables vary as exp (ik.x-iωt).

(b) Show that the dispersion relation for the frequencies of the different modes in terms of the wave number can be written.

$\omega^2(\omega^2-\omega_p^2)\,(\omega^2 - \omega^{p2} - k^2c^2) = \omega^2_B\,(\omega^2 - k^2c^2)\,[\omega^2\,(\omega^2 - \omega p^2 - k^2c^2) + \omega p^2 c^2\,(k\,.b)^2]$

where b is the unit vector in the direction of B, ω_p and ω_B are the plasma and precession frequencies, respectively.

(c) Show that for propagation parallel to B_0 the dielectric constant is recovered.

(d) Assuming $\omega_B << \omega_p$, solve approximately for the various roots for the cases

(i) K parallel to b

(ii) K perpendicular to b. Sketch your result for w^2 versus k^2 in the two cases.

Books Recommended

- Bitteneerort Plasma Physics
- Chen Plasma Physics
- Gupta, Kumar, Singh Electrodynamics
- Sen Plasma state and matter
- Jackson Classical electrodynamics
- Pamolsky & Philips Classical electricity and Magnetism

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.)
End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. II Semester **Max Marks- 40**

Passing Marks - 14

Paper-IV: Condensed Matter Physics

Course Objective

The objectives of the course are:

No	Course Objective	Cognitive Level
CO-I	To expose the students with different XRD techniques to determine crystal structure, Elementary idea of defects in crystals	U,An,Ap
CO-II	Acquire knowledge about behavior of electrons in solids based on classical and quantum theories	U,R,E,C
CO-III	To get familiarized with the basics of superconductivity	U,R
CO-IV	To get elementary idea about dielectric properties	U
CO-V	To become familiar with the different types of magnetism	R

CO- Course Objectives

Course Outcome

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will be able to understand the Interaction of X-Ray with matter and Crystal Defects	1	U, R
CLO-II	Learner will be able to explain concept of Free electron Fermi gas, Energy bands and band theory	1,3,4	U, Ap ,C
CLO-III	Learner will be able to classify atomic and molecular polariziblity and its related phenomena	1,5	U, An, R
CLO-IV	Learner will be able to understand Super	2,5	U , E

	conductivity		
CLO-V	Learner will be able to explain Theories of Ferromagnetism	1,4	U, R ,AP

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit - I

Interaction of X-ray with matter, absorption of X-rays, Elastic scattering from a perfect lattice. The reciprocal lattice and its application to diffraction techniques, the Laue, power and rotating crystal methods. Crystal structure factor and intensity diffraction maxima. Extinction due to lattice centering.

Point defeats, line defects and planer (stacking) faults. The role of dislocation in plastic deformation and crystal growth. The observation of imperfections in crystals. X-ray and electron microscopic techniques

Unit - II

Free electron Fermi gas, Energy levels of orbital in one and three dimensions. Electrons in a periodic lattice. Bloch theorem, band theory of solids, Classification of solids effective mass. Tight binding, cellular and pseudopotential methods. Fermi surface. De Hass von Alfen effect, Super conductivity, critical temperature persistent current. Meissner effect, general idea about high temperature superconductors.

Unit-III

Atomic and molecular Polariziblity, Claussius-Mossotti relation, types of polarzibility, dipolar polarizibility and frequency dependence of dipolar polarizibility, ionic and electronic polarizibilty, Hall effect. Quantum Hall Effects, Magnetoresistance.

Unit - IV

Weiss Theory of Ferromagnetism. Heisenberg model and molecular field theory, spin waves and magnous, Curie-waves law for susceptibility, ferri and anti-Ferro-magnetic order. Domains and Bloch-wall energy.

Unit - V

This unit will have questions covering all the four units. In addition to the problems given below the unit will consist of problems given in Text / Reference books.

(1) Given that the primitive basis vectors of a lattice a = (a/2) (i + j), b = a/2 (j + k) and c = a/2 (k + j) where i, j and k are usual three unit vectors along cartesion coordinates. What is the Bravais lattice?

(2) Determine planes in a fcc structure having highest density of atoms.

Or

Evaluate density of atoms for Cu in atoms/cm^2.

(3) For the delta function potential and with $p > 1$ find at $k = 0$ the energy of the lowest energy band. Also find the band gap at $k = \pi/a$.

(4) Consider a square, lattice in two dimensions with the crystal potential.

$U(x,y) = .4U \cos(\pi x/a) \cos(\pi y/a)$

Apply the central equation to find approximately the energy gap at the corner point $(\pi/a, \pi/a)$ of the Brillouine Zone.

(5) Explain why the Hall constant is inversely proportional to the electron concentration M.

Books Recommended

- Kittle : Solid State Physics
- Aschroft & Mermin : Solid State Physics
- L.V. Azaroff : Introduction to Solid State Physics
- Verma & Srivastava : Crystellographic Solid State Physics
- A.J. Dekker : Solid State Physics
- P.M. Chaiken & T.C. Lubensky: Principles of Condense Matter Physics

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.), End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M.SC. (PHYSICS) I & II SEMESTER: PRACTICAL COURSE

Note: Appropriate other experiments can be added based on prescribed syllabus in both labs A and B

LAB : A

Max. Marks: 50

Min. Marks: 18

Miscellaneous Topics in Optics I & II

(Preferably Five experiments per semester to be performed by the students)

1. Determination of the Wavelength of the LASER Light source using plane Transmission Gratting.
2. Determination of Separation Between Two Plates of Fabry Perot Etalon with the help of He- Ne Laser.
3. Determination of the radius of Curvature of Plano- convex Lens by Newton's Ring Method .
4. Determination f Wavelength of Spectral Line by Constant deviation Spectrograph.
5. Determination of Refractive index of the material of the prism By Using Spectrometer And Laser And Plotting i-δ Curve.
6. Sodium Light Determination of the Wavelength of the Source Fresnel's Biprism.
7. To Find the Brewster's angle of the Prism using Spectrometer and Polarizer.
8. To Find the Refractive Index of Water and to Study the variation of Refractive index With Wavelength of the Light Source.
9. To Find the Refractive index of Sugar Solution and to Study the Variation of the Refractive index with difference molar Concentration.
10. To measure the LASER beam divergence using Photo Sensor by Plotting the distance vs. current graph.
11. To Determine the Elastic constant of acrylic beam by Cornu's method.
12. To determine the Wavelength of the of the LASER Light Source using Plane Transmission grating.
13. Optical Fiber : (a) Determination of numerical aperture (b) Attenuation Loss (c) Bending loss.
14. Production and study of elliptically and circularly polarized light by Fresnel's Rhomb.
15. Verification of Hartman's formula by constant deviation spectrometer.
16. Verification of Fresnel's law of reflection for polarized light.

St. Aloysius' College (Autonomous), Jabalpur

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2023-24

M.SC. (PHYSICS) I & II SEMESTER: PRACTICAL COURSE

Note: Appropriate other experiments can be added based on prescribed syllabus in both labs A and B

LAB –B (ELECTRONICS –I & II)

Max. Marks: 50

Min. Marks: 18

(Preferably Five experiments per semester to be performed by the students)

(1) To study IV Characteristics of LED of different colour and determination of their threshold voltage and wavelength.

(2) To verify the De'Morgans theorem using the Logic gate.

(3) Design of a regulated power supply using IC78XX(7805,7809,7812).

(4) To study the truth table of RS Flip flop.

(5) To study the truth table of JK Flip flop.

(6) To verify truth table of NOT, AND, NAND, OR, NOR, Ex-OR using IC 74XX series.

(7) To design half adder using 74XX series IC.

(8) To design and study Astable multivibrator.

(9) To design a differentiator using IC 741 on multisim software and get different waveform for different input.

(10) To design a integrator using IC 741 on multisim software and get different waveform for different input.

(11) Design of a regulated power supply using IC78XX (7805, 7809, 7812) in multisim software.

(12) To design a adder and substractor using IC 741 on multisim software/ IC74XX.

(13) To design and study Butterworth High pass filter using IC 741 in multisim

(14) To design and study Butterworth Low pass filter using IC 741 in multisim

(15) Study of Astable, Monostable and bistable Multivibrator using IC 555.

(16) Characteristics and application of Silicon controlled Rectifier.

(17) Experiment on FET and MOSFET characterization and application as an amplifier.

(18) Experiment an UJT and its applications.

St. Aloysius' College (Autonomous), Jabalpur

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Under CBCS System

2023-24

M.Sc. Physics: Program Specific Outcomes (PSO)

After undertaking a course of M.Sc. Physics, the learner shall be able to:-

No.	**Program Specific Outcomes**
PSO 1	To provide a thorough knowledge of the fundamental concepts in all of the main disciplines of physics. providing a well-defined study of theoretical and experimental physics.
PSO 2	Plan and carry out experiments that show a comprehension of scientific principles, procedures, and phenomena.
PSO 3	Recognize the value of approximation and mathematical techniques to represent the physical world, as well as the relevance of mathematical modeling, simulation, and computation.
PSO 4	Have a working knowledge of the analytical techniques needed to evaluate and analyze data and form conclusions. Apply conceptual understanding and critical thinking to general real-world situations
PSO 5	Equip the student to pursue research and development in any of the major areas of Physics. Communicate physics-related themes to society show casing the influence of science, particularly physics, on society.

St. Aloysius' College (Autonomous), Jabalpur

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2023-24

M. Sc. III Semester **Max Marks- 40**

Passing Marks - 14

QUANTUM MECHANICS – II

Course Objectives

To communicate knowledge of advanced quantum mechanics for solving relevant physical problems. Its primary objective is to:

No.	Course Objectives	Cognitive Level
CO-I	Learn methods to solve Schrodinger's equation by WKB method, Variational method and Time independent perturbation method	U,Ap,C
CO-II	Learn to apply Time dependent approximate method in Quantum Mechanics to solve several problems	Ap,An,E
CO-III	Impart knowledge about Scattering theory through Born approximation and partial wave analysis	U,Ap
CO-IV	Learn the basics of relativistic quantum Mechanics	U,R

CO- Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	The Learner will get familiar with quantum mechanics formulation and approximation methods.	1,3,4	U,
CLO-II	The Learner will understand and apply Time dependent and Independent	1,4	R, U, Ap,

	perturbation theories		An
CLO-III	The Learner will understand and explain the influence of electric and magnetic fields on atoms. (Stark effect and Zeeman Effect).	2,4,5	R, U, Ap, An
CLO-IV	The Learner will understand and develop the Scattering theory through Born approximation and partial wave analysis.	3,5	U ,R, Ap, E, C
CLO-V	The Learner will understand Relativistic quantum Mechanics.	1,2,3	U, R

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

UNIT - I

Approximation method for bound states : Rayleigh-Schrodinger perturbation theory of non-degenerate and degenerate levels and their application to perturbation of an oscillator and First order Stark effect in Hydrogen.

Variation method and its application to ground state of helium,

W.K.B. approximation method, connection formula, Ideas on potential barrier with applications to the theory of alpha decay.

UNIT-II

Time dependent perturbation theory : Method of variation of constants, constant and harmonic perturbation, transition probability, adiabatic and sudden approximation. Hamiltonian for a charged particle under the influence of external electromagnetic field, Absorption and induced emission, Transition probability in Electric dipole transition, Einstein's A and B coefficients.

UNIT - III

Theory of scattering, Physical concepts, Differential and total cross sections, scattering amplitudes using Green's function.

Born approximation, Validity of Born Approx., scattering by screened coulomb potential

Partial wave analysis, phase shift, optical theorem, scattering by square well potential and perfectly rigid sphere.

UNIT - IV

Schrodinger's relativistic equation (Klein-Gordon equation), Probability and current density, Klein-Gordon equation in presence of electromagnetic field, Hydrogen atom, short comings of Klein-Gordon equation.

Dirac's relativistic equation for a free electron, Dirac's matrices, Probability and current density, spin of an electron, spin - orbit interaction , Equation of motion for operators, position momentum and angular momentum, Dirac's relativistic equation in electromagnetic field, Zitterbewegung, negative energy states and their interpretation, Energy levels of Hydrogen atom

Unit - V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Normal Zeeman Effect.
2. Anomalous Zeeman Effect.
3. Van der Waals interactions.
4. Evaluate Einstein's A coefficient for the transition from state |310> to state |200> in the hydrogen atom.
5. Selection rules for single and many particle systems.
6. Ramasuer- Townsend effect.
7. Evaluate the scattering amplitude in the Born approximation for scattering by the Yukawa potential $V(r) = \frac{V0e^{-\alpha r}}{r}$, Where V_0 and α are constant
8. Covariance form of Dirac equation.
9. The probability current density is defined by the relation $\mathbf{j(r,}t) = c\ \psi^*\alpha\psi$, where ψ is the four-component wave vector. Write expressions for j_x, j_y and j_z in terms of the components of ψ.
10. Show that $(\alpha.A)(\alpha.B)=(A.B)+i\sigma'.(A\times B)$, where A and B commute with α and $\sigma' = \begin{bmatrix} \sigma & 0 \\ 0 & \sigma \end{bmatrix}$
11. Magnetic moment and spin of a Dirac's electron.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

QUANTUM MECHANICS	**:**	**L. I. SCHIFF**
Quantum Mechanics	:	S. Gasiorowicz
Quantum Physics	:	B. Craseman and J.D. Powell
Quantum Mechanics	:	A.P. Messiah
Modern Quantum Mechanics	:	J.J. Sakurai
Quantum Mechanics	:	Mathews and Venkatesan
Quantum Mechanics	:	A.K. Ghatak and Loknathan
Quantum Mechanics	:	G. Aruldhas

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. III Semester **Max Marks- 40**

Passing Marks - 14

PAPER II

NUCLEAR AND PARTICLE PHYSICS

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To impart knowledge regarding the fundamentals and basics of Nuclear interactions and Nuclear Reactions	U,R,Ap
CO-II	To impart knowledge about basic nuclear physics properties and nuclear models for understanding of related reaction dynamics	U,R,An
CO-III	To impart knowledge of elementary particles and their classification, fundamental interaction and the range and strength of these interactions with the concept of particle antiparticle or matter antimatter	U,R,Ap
CO-IV	To have an understanding of nuclear decay theories	U,E
CO-V	To have an idea of the basic nature and origin of Cosmic rays	U,C

CO-Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	The Learner will summarize the properties of a nucleus, packing fraction and binding energy, binding energy per nucleon vs. mass number graph, explanation of fusion and fission from the nature of the binding energy graph.	1,2	U, R, E
CLO-II	The Learner will interpret Nuclear models and their roles in explaining the ground state	3	U, R. Ap

	properties of the nucleus.		
CLO-III	The Learner will analyze the Process of radioactivity and radioactive decay laws.	4	U, Ap, An
CLO-IV	Learner will understand the basic aspects of Nuclear detectors and particle accelerators.	2,4,5	U , Ap, E, C
CLO-V	Learner will understand the importance of Cosmic Rays.	1	U

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

UNIT – I

Nuclear Interactions and Nuclear Reactions

Nucleon- nucleon interaction, exchange forces and tensor forces, meson theory of nuclear forces, nucleon, nucleon scattering, Effective range theory, spin dependence of nuclear forces, charge independence and charge symmetry of nuclear forces, Isospin formalism, Yukawa interaction.

Direct and compound nuclear reaction mechanisms, cross sections in terms of partial wave amplitudes, compound nucleus, scattering matrix, Reciprocity theorem, Breit- Wigner one–level formula, Resonance scattering.

UNIT - II

Nuclear Models

Liquid drop model, Bohr–wheeler theory of fission, Experimental evidence for shell effects- shell model, spin, orbit coupling, magic numbers, Angular momenta and parities of nuclear ground states, Qualitative discussion and estimates of transition rates, magnetic moment and Schmidt lines, Collective model of Bohr and Mottelson .

UNIT – III

Nuclear Decay

Beta decay, Fermi theory of beta decay, Comparative half, lives, Parity violation, Two component theory of neutrino decay, Detection and properties of neutrino Gamma decay, Multipole transition in nuclei Angular momentum and parity selection rules Internal conversion, Nuclear isomerism.

General ideas of nuclear radiation detectors, Linear acceleration, Betatron, Proton-synchrotron, Electron synchrotron.

UNIT - IV

Elementary particle physics

Types of interaction between elementary particles, Hadrons and leptons, Symmetry and conservation laws, Elementary ideas of : CP and CPT invariance, Classification of hadrons, lie algebra, SU(2) – SU (3) multiplets, Quark model, Gell Mann- Okubo mass formula for octet and decuplet hadrons, Charm, bottom and top quarks.

Cosmic Rays

Nature, composition, charge and energy spectrum of primary cosmic rays, production and propagation of secondary cosmic rays. Soft, penetrating and nucleonic components, Origin of cosmic rays, Rossi curve, Bhabha – Heitler theory of cascade showers.

UNIT – V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Scattering Matrix.
2. Nucleon- Nucleon phase Shifts.
3. Double Scattering Experiment to measure polarization.
4. Ground state spectroscopic configuration of nuclei on the basis of single particle shell model.
5. The Q – Equation.
6. Calculation of Absorption Cross Section.
7. Nuclear Quadrapole moment.
8. Kurie Plot
9. Selection Rules for β and γ decay.
10. Parity Violation Experiment.
11. Neutrino Helicity.
12. Isospin Symmetry.
13. Lie Algebra.
14. Origin of cosmic rays.
15. Bhabha-Heitler theory.

In addition to above the tutorial will also consist of solving problems given in the Text and Reference books.

Text and Reference Books

- Kenneth S. Kiane. Introductory Nuclear Physics, Wiley New York 1988..
- H.A. Enge, Introduction to Nuclear Physics, Addison- Wesley ,,1975.
- G.E.Brown and A.D. Jackson, Introduction to Nuclean nucleon Interaction, North – Holland, Amsterdam, 1976.
- Y.R. Waghmare, Introductory Nuclear Physics, Oxford-IBH Bombay,1981
- I. Kaplan, Nuclear Physics, 2" Ed. Narosa, Madras, 1989
- R.D.Evans, Atomic Nucleus, McGraw Hill, New York, 1955.
- B.L. Cohen, Concepts of Nuclear Physics, TMGH, Bombay, 1971.
- R.R. Roy and B.P. Nigam Nuclear Physics, Wiley- Eastem Ltd, 1983.
- Bruno Rossi, Cosmic Rays
- B.N. Shrivastava, Basic Nuclear Physics and Cosmic Rays
- M.P. Khanna, Particle Physics, Prentice Hall
- Burcham, Nuclear Physics

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. III Semester **Max Marks- 40**

Passing Marks - 14

Papers III

SPECIAL PAPER (a) CONDENSED MATTER PHYSICS – I

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To obtain an understanding of the concepts of solid state physics	U,R
CO-II	To become familiar with the effect of defects and deformation behavior of solids	U,An,Ap
CO-III	To make students aware of different types of materials in their bulk and thin film forms and their properties	U,C,E
CO-IV	To develop an understanding of lattice dynamics of Monatomic and Diatomic lattice	U,An
CO-V	To give the basic knowledge of Optical Properties of Solids.	U,R

CO- Course Objectives

Course Learning Outcome

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will recall and compare the Imperfections and dislocations in crystals	1,5	U, R
CLO-II	Learner will understand Partial dislocations and the techniques of observing them through like XRD, TEM, SEM and AFM.	2,3,5	U , Ap, E
CLO-III	Learner will understand the importance of	2,4	U,C, R

	Thin films, surface topography.		
CLO-IV	Learner will understand and simplify Lattice Dynamics, Optical Properties of Solids and its related phenomena.	1,4	U , An
CLO-V	Learner will understand various optical properties of Solids	1,5	U, R, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit - I

Imperfection in Crystals

Mechanism of plastic deformation in solids, stress and strain field of screw and edge dislocations. Elastic energy of dislocations. Forces between dislocations. Stress needed to operate Frank-Read source, dislocations in fcc, hcp and bcc lattices.

Unit - II

Partial dislocations and stacking faults in closed packed structures. Experimental methods of observing dislocations and stacking faults. Electron microscopy, kinematical theory of diffraction contrast and lattice imaging.

Elementary concepts of surface crystallography. Scanning tunneling and atomic force microscopy.

Unit - III

Films and Surface

Study of surface topography by multiple-beam interferometry, conditions for accurate determination of step height and film thickness (Fizeau Fringes). Electrical conductivity of thin films, difference of behaviour of thin films from bulk, Boltzmann transport equation for a thin film (for diffused scattering), expression for temperature coefficient of resistivity of thin films.

UNIT – IV

LATTICE DYNAMICS

Lattice Dynamics of monatomic and Diatomic lattice, Optical phonons and dielectric constants. Mossbauer effect, Debye – Waller factor Anharmonicity, Thermal expansion and thermal conductivity. Umklapp process, Interaction of electrons and phonons with photons.

Optical Properties of Solids

Direct and indirect transitions. Absorption in insulators, polaritons, one phonon absorption, optical properties of metals, skin effect and anomalous skin effect.

UNIT – V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Consider two parallel dislocation lying on the same slip plane. Their Burgers vectors lie parallel to the slip plane but are not parallel to each other. Their magnitudes are equal. Find all possible orientations of the Burgers vectors for which the component of the force between the dislocations that acts parallel to the slip plane is zero.
2. Prove that the stress σ_{zz} never exerts a force on a dislocation in which burgers vector lies parallel to the x direction regardless of the orientation of the dislocation line.

3. Derive Taylor's relation between dislocation density and applied stress.
4. Discuss the working of atomic force microscope
5. Bring out the essential differences between diffuse and specular electron scattering from the conventional solid: bulk and films by taking the specific property of electrical conductivity.
6. What are thin and thick film? With reference to electronic conduction which films can be referred to as thin and which as thick taking into account the mean free path as a reference parameters.
7. Estimate for 300 K the root mean square thermal dilation AV/V for a primitive cell of sodium. Take the bulk modufus as 7×10^{10} erg cm^{-3}. Note that the Debye temperature 158 K is less than 300 K so that the thermal energy is of the order of K_BT. Use this result to estimate the root mean square thermal fluctuation $\Delta a/a$ of the lattice parameter.
8. Consider a classical harmonic oscillator with small anharmonic terms so that the potential energy is $V(x) = ax^2 + bx^3 + cx^4$. Using the partition function approach show that the mean energy (ξ) and mean thermal displacement from equilibrium (x) are :

$$(\xi) = K_BT\,[15b^2/16a^2 - 3c/4a^2]\,(K_BT)^2$$

$$(x) = -(3b/4a^2)\,K_BT$$

The former leads to a high temperature contribution to the specific heat that is linear in temperature. The latter is an indication of the origin of thermal expansion (and the proper sign of the coefficient)

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

X-ray crystallography	:	Azaroff
Elementary Dislocation Theory	:	Weertman & Weertman
Crystallography for Solid State Physics	:	Verma & Srivastava
Solid State Physics	:	Kittel
The Powder Method	:	Azaroff & Buerger
Crystal Structure Analysis	:	Buerger
Transmission Electron Microscopy	:	Thomas
Multiple Beam Interferometry	:	Tolansky
Thin films	:	Heavens
Physics of thin film	:	Chopra
Introduction to Solid State Theory	:	Medelung
Quantum Theory of Solid State	:	Callaway

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. III Semester **Max Marks- 40**

Passing Marks - 14

PAPER IV

SPECIAL PAPER (b) A Course In COMPUTATIONAL PHYSICS USING MATHEMATICA– I

Course Objectives

Course Objectives: The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To enable students with the concept and use of a symbolic algebra computer package - in the Mathematica® environment	U,C
CO-II	To get equipped with a range of commands and the syntax	U,R,AP
CO-III	To acquire the ability to learn, write and run Mathematica® programs	Ap,C,An,E
CO-IV	To acquire the ability to plot different functions and data sets for visualization	An,C
CO-V	To acquire the ability to solve various types of problems through Mathematica®	E
CO-VI	To learn how to do Simulation of ODE Models through Mathematica®	C

CO- Course Objectives

Course Learning Outcomes

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	The learner will use various computer algebra commands for different mathematical operations and plot different functions and data sets	**1,2,3**	**U, C**

CLO-II	The learner will apply the Mathematica ® system to solve equations and do manipulations of matrices and determine eigen values and eigen vectors	**3,4**	**R,U, Ap, E**
CLO-III	The learner will use the Mathematica® environment to create user defined functions	**5**	**U, Ap, C**
CLO-IV	Learner will use the Mathematica® to plot and interpret different functions/models in Physics	**3,5**	**U , Ap, E**
CLO-V	Learner will use the Mathematica® to Simulate ODE Models	**3**	**U, An, C**

COU – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit – I

Basics of Mathematica Programming. Mathematica commands I:

Introduction, commands and variables, numerical calculations with examples such as Factorial, Exponential etc. Symbolic calculations: Use of Solve on equations. Calculus (differential and integrals). Manipulations with matrices, eigen values and eigen vectors. Write a program to calculate and print roots of a quadratic $ax^2+bx+c = 0$ ($a \neq 0$).Write a program to add and multiply two matrices. Plots of data and functions.

Unit – II

Mathematica commands II:

DSolve, Map, Part, With, Block, Module, Replace(/.), Conditional commands(Piecewise). Use of the commands: Import and Export. Importing data into a notebook from a file with 'xls', 'txt', 'dat' extension. Import of images in 'jpeg' format. Exporting data from a notebook into a file with 'xls', 'txt', 'dat' extension. Exporting of images in 'jpeg' format.

Unit – III

Mathematica commands III:

Pure Functions; SetDelayed; Table. Illustrate the use of a User-Defined function by a program. Make a plot of the User-Defined function by using 'Plot' also by using 'Table' and 'ListPlot'.(1)Relativistic variation of mass with velocity.(2) P-N Junction (semiconductor diode) current equation. (3)Potential Energy Curve for the Lennard-Jones Potential.(4)Van der Waals' Equation of State for a Non-Ideal Gas.(5) Resonance plots of a LCR circuit.

UNIT – IV

Application of Mathematica to problems in physics - I:

(1) Escape velocity for a particle tossed upward from the surface of the earth. escape velocities for other planets;(2)Orbital velocity, geo-synchronous orbit; (3)Study of " harmonic motion :- $mx''+cx'+sx = 0$. for $c^2-4mk>0$, over damped; $c^2-4mk=0$, critically damped; $c^2-4mk<0$, under damped"; (4) "Phase plot of a system undergoing linear

oscillations ";(5) Potential energy and kinetic energy diagram of the linear harmonic oscillator.

Unit – V

Application of Mathematica to problems in Physics - II:

(1) Application of Kirchhoff's Voltage Law and Current Law to electrical meshes(Use of Simultaneous Equations/Matrices), (2) Charging and Discharging in a R-C Circuit, (3) Study of Charging and Discharging in circuits with inductors, capacitors and resistors, (4)Nuclear Forces(Comparison of Yukawa Potential, Exponential Potential, Gaussian Potential and Hard Core Potential) , (5) Radioactive Decay and Half Life.

Text and Reference Books

1. Programming in Mathematica: Roman Maeder, Addison Wesley.
2. Mathematica in the Laboratory: Samuel, Dick, Alfred Riddle, Douglas Stein, Cambridge University Press.
3. Introductory Statistics and Random phenomena: Manfred Denker and Wobor A. Woyczynski, Springer (India) Pvt. Limited.
4. Computational Physics: R. C. Verma, P. K. Ahluwalia and K.C. Sharma, New Age Publishers (1999)
5. Numerical Recipes in C ; Press W.H., Teukolsky S.A. Vellerling W.T. and Flannery B.P. (Cambridge Univ. Press 1992)
6. Simulation using Personal Computers: Carroll, J.M. (Prentice Hall, 1987)
7. www.wolfram.com
8. http://demonstrations.wolfram.com/HeatCapacityOfSolidsInTheDebyeApproximation/
9. http://demonstrations.wolfram.com/PlotsOfTheFermiDiracDistribution/
10. http://demonstrations.wolfram.com/FermiDiracDistributionsForFreeElectronsInMetals/
11. http://demonstrations.wolfram.com/FrequencyResponseOfAnLCRCircuit/

Mode of Evaluation: CCE (Digital Assignments, Presentation, Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

Paper - I

ATOMIC AND MOLECULAR PHYSICS

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To learn about the spectra of one and two electron system	U,R
CO-II	To understand the details of rotational spectra of diatomic molecules, technique and instrumentation for microwave spectroscopy	U,Ap,An
CO-III	To know about the vibrational spectra of molecules and elements of IR spectroscopy	An,C
CO-IV	To equip them with the knowledge of Raman spectroscopy and familiarity with instrumentation of PES, PAS, NMR and Mossbauer spectroscopy	E

CO- Course Objectives

Course Learning Outcome

The students are expected to acquire the knowledge of the following:

	Course Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will understand Quantum states, spectra of one and many electron systems along with hyperfine structure.	1,5	U
CLO-II	Learner will be able to explain Normal and anomalous Zeeman effect	2	U, Ap

CLO-III	Learner will be able to understand the Rotational Spectra of diatomic molecules, Isotopic effect, Microwave Spectroscopy.	3,4	U, Ap, An
CLO-IV	Learner will be able to understand and analyse Vibrational and rotational motion of molecule, transition rules, analysis of IR spectrum.	3,4,5	U , Ap, E
COL-V	Learner will build the conceptual understanding of Raman Spectra, Electronic spectra, Photo Electron Spectroscopy, Photo acoustic Spectroscopy, Mossbauer spectroscopy and NMR Spectroscopy.	5	U,C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit –I

Quantum states of one electron atoms Atomic orbitals, Hydrogen spectrum, Paulis principle. Spectra of alkali elements, spin orbit interaction and line structure of alkali spectra, Two electron system, interaction energy in LS and JJ coupling, Hyperfine structure (qualitative), line broadening mechanisms (general ideas), Normal and anomalous Zeeman effect, Lande g-factor.

Unit – II

Microwave Spectroscopy: Introduction to molecular spectroscopy, Regions of the Spectrum. Types of molecules, Diatomic linear, symmetric top, asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as a rigid rotator, Energy level and spectra of non-rigid rotator, intensity of rotational lines, Isotopic effect in Rotational Spectra, Technique and Instrumentation for Microwave Spectroscopy.

Unit – III

Infra-Red Spectroscopy: Vibrational Energy Of Diatomic Molecule, Diatomic Molecule As A Simple Harmonic Oscillator, Energy Levels And Spectrum, Morse Potential Energy Curve, Molecules As Vibrating Rotator, Vibration Spectrum Of Diatomic Molecule Pqr Branches, Technique And Instrumentation For Infra-Red Spectroscopy, Example Of Analysis Of Ir Spectrum.

Unit – IV

Raman spectroscopy: Introduction, Pure rotational and vibrational spectra, Techniques and instrumentation, Stimulated Raman spectroscopy.

Electronic Spectra of Diatomic Molecules: The Born Oppenheimer Approximation, Vibrational Coarse Structure Progressions, Rotational fine structure of Electronic-Vibrational Transitions.

Experimental techniques: Photo Electron Spectroscopy, Elementary idea about Photoacoustic Spectroscopy, Mossbauer spectroscopy and NMR Spectroscopy.

Unit –V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Write all possible term symbols for the following electron configurations

   (a)[Be]2p3p (b) [He]2s2p

2. Compute the Zeeman pattern, Arising terms, No. of Zeeman level, g-factor and Shift in Lorentz unit for following:

   (a) $^2D_{3/2}$-$^2P_{1/2}$ (b) $^3P - {}^3S$

3. The measured value of the first line (J = 0) in the rotational spectrum of carbon monoxide is 3.84235 cm^{-1}. Determine the moment of inertia and bond length of the molecule.

4. The data for the $^1H^{35}Cl$ molecule are :

   Bond length = 127.5 pm

   Bond force constant = 516.3 Nm^{-1}

   Atomic masses : $^1H = 1.673 \times 10^{-27}$kg, $^{35}Cl = 58.066 \times 10^{-27}$ kg

   Determine the following:

   (a) The energy of fundamental vibration ν_o.

   (b) The rotational constant B.

   (c) The wave numbers of the line $P_{(1)}$, $P_{(2)}$, $R_{(0)}$, $R_{(1)}$ and $R_{(2)}$.

   (d) Sketch the expected vibration-rotation

5. How many normal models of vibration are possible for the H_2O molecule?

6. The bond between the hydrogen and chlorine atoms in a $^1{}_1H^{17}{}_{35}Cl$ molecule has a force constant of 516 nt/m. Calculate the energy difference between the lowest and first excited vibrational level.

7. The molecules of $^1{}_1H^{17}{}_{35}Cl$ show a strong absorption line of wavelength 3.456 microns. Assuming origin of line due to vibration, calculate the force constant for $^1{}_1H^{17}{}_{35}Cl$ bond. ($h=6.6\times10^{-34}$Jsec, $1amu=1.67\times10^{-27}$kg)

8. With which type of spectroscopy would one observe the pure rotational spectrum of H_2? If the bond length of H_2 is 0.07417 nm. What would be the spacing of the lines in the spectrum?

9. A substance shows a Raman line at 4567Å when exciting line 4358 Å is used. Deduce the position of Stoke and anti-stoke lines for the same substance when the exciting line 4047 Å is used.

10. In the Raman spectra of HCl, the displacement from the exciting line are represented by

$$\Delta\upsilon = \pm (62.4 + 41.6\ J)\ cm^{-1}$$

Calculate the moment of inertia of the HCl molecule ($h= 6.62\times10^{-27}$ erg-sec, $c= 3\times10^{10}$cm-sec^{-1})

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books:

- Introduction to Atomic Spectra : H.E. White
- Fundamentals of molecular spectroscopy : C.B. Banwell
- Atomic & Molecular Spectroscopy : Rajkumar
- Spectroscopy vol. I, II & III : Walker and Stanghen
- Introduction to molecular spectroscopy : G.M. Barrow
- Spectra of diatomic molecules : Herzberg.

- Molecular spectroscopy : Jeanne L. Mc Hale
- Molecular spectroscopy : J.M.Brown
- Spectra of atoms and molecules : P.F.Bemath.
- Modern spectroscopy : J.M. Halian
- Spectroscopy : Gour
- Atomic & Molecular Physics : Rajkumar

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2021 Onwards

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

Paper - II

Elective paper

(ANY ONE TO BE OPTED)

ELECTIVE PAPER (a): CONCISE STUDY OF NON-LINEAR SYSTEMS

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To enable students to classify singular points and their stability and generate phase space and trajectories in phase space	U,Ap
CO-II	To enable to use Lyapunov's theorem for stability	Ap,An
CO-III	To acquire the ability to comprehend, understand and do qualitative analysis of illustrated examples of dynamical systems from other disciplines like chemistry, biology and electronics	An,C
CO-IV	To enable to define, characterize and detect chaos and its sensitive dependence on initial conditions with examples from the Logistic Map problem and other physical systems Lorentz equation etc	U,R,E
CO-V	To enable locate examples of fractals as self-similar structures from Nature and find the fractal dimension	An,E
CO-VI	To enable to do Simulation of Simple Population Models, Experimental growth and Decay, Logistic growth, Species Competition, Predator-Prey Dynamics, Simple electric circuits	An,Ap,C
CO-VII	To enable to solve rate equations numerically for some simple chemical reactions	E

CO- Course Objectives

Course Learning Outcome

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	The learner will Understand the idea of dynamical systems, phase space and trajectories in phase space. Simple examples from mechanical systems	1,5	U
CLO-II	Comprehend illustrated examples of dynamical systems from other disciplines like chemistry, biology and electronics and apply to do the qualitative analysis of some simple examples	**2,3,4**	R,An
CLO-III	Lerner will Learn to use a software packages like Mathematica to generate and visualize various trajectories	3,4,5	**Ap**
CLO-IV	Understand chaos and their sensitive dependence on initial conditions with examples from the Logistic Map problem and other physical systems Lorentz equation etc. Understand fractals as self-similar structures by giving examples from Nature and develop mathematical models for simple fractal structures	1,3	C
CLO-V	Ability to define, characterize and detect various types of chaos and their dependence on initial condition using various order parameters	1,4	U
CLO-VI	Understand basic Physics of fluids and its dynamics theoretically and experimentally and by computational simulations	1,3	U,E
CLO-VII	Understand the Physics of different types of fluid flow phenomena as well as fluid flow visualizations like streamlines flow	1	U,An
CLO-VIII	The students will perform Simulation /Computer experiments/Lab experiments	3	C,E
CLO-IX	Simulation of Simple Population Models, Experimental growth and Decay, Logistic growth, Species Competition, Predator-Prey	3	An,Ap

	Dynamics, Simple genetic circuits		
CLO-X	Solve rate equations numerically for some simple chemical reactions	4	Ap

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit I

Phase space, orbits, attractors and basin of attraction. Use of the Jacobian matrix in Analysis of Singular points. Classification of Singular points and their stability. Poincare's theorem for the vortex. Use of Lyapunov's theorem for stability. Limit cycles. Poincare sections (Stroboscopic section and transverse sections). Distinction between Non conservative and Conservative Maps taking as example the Henon map

Unit II

Iterated functions. The Logistic Map. Its geometrical representation and period doubling cascade to chaos. Bifurcation, stability and Feigenbaum number. Characterizing chaos by the Lyapunov exponent. Strange attractors in the form of the Lorenz system and Rossler system.

Unit III

Non-fractal dimensions (Euclidean and topological). Fractal Dimensions and similarity dimension. Cantor Sets, Koch curve and Sierpinski gasket. Fractal boundaries and box counting dimension. The structured walk technique and the divider dimension. The Richardson plot. The perimeter-area relationship in fractals.

Unit IV

Overview of different nonlinear systems. (Study based on phase plot or graphical representation of the equations of nonlinear systems)

a. Nonlinear Mechanics: The Simple Pendulum
b. Biological Systems: Volterra-Lotka Competition Equations
c. Electronic Systems: Van der Pol Oscillator
d. Chemical Systems: Chemical Oscillators(The Brusselator / Oregonator)
e. Fluid Motion: Rayleigh–Benard Convection
f. Solitons: Shallow water waves (KdV equation)

Unit V

This unit will have tutorial problems covering all the four units. Some sample problems are:

Overview of different nonlinear systems. (Study based on phase plot or graphical representation of the equations of nonlinear systems.)

a. Chaotic oscillation of the Duffing Oscillator
b. Self similarity (Fractal structure) in the Henon map
c. Self similarity (Fractal nature) of Julia sets
d. Self similarity (Fractal nature) of Mandelbrot sets
e. Cellular Automata as examples of simple rules leading to complex patterns.
f. Self similarity (Fractal nature) of Cellular Automata

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Suggested Books:

a. The New Kind of Science Book by Stephen Wolfram
b. Non linear Dynamics by H G Solari, M A Natiello and G B Mindlin
c. Introduction to Chaos by H Nagashima and Y Baba
d. Deterministic Chaos by N Kumar
e. Fractals and Chaos by Paul S Addison
f. Non linear Physics for Students and Engineers by Enns and Mc Guire
g. Non Linear Dynamics and Turbulence by Barenblatt, Looss and Joseph

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks – 14

PAPER II

ELECTIVE PAPER (b): PHYSICS OF LASERS ITS APPLICATIONS

Course Objectives

The Objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To identify necessary conditions for lasing action and properties of the laser	U,R
CO-II	To classify lasers on the basis of design and working principles	An,Ap
CO-III	Develop an idea of Laser fluorescence, Raman scattering and their applications	C,E
CO-IV	To illustrate various aspects of crystal optics and different non-linear optical phenomenon	U

CO- Course Objectives

Course Learning outcome

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will recall and summarize Basics of lasers , working principle of lasers	1,3,5	U,R
CLO-II	Learner will understand Structure and basic operating principles of different laser systems and their applications	1,4	U,R, Ap, C
CLO-III	Learner will be able to explain Laser based various spectroscopic techniques	2	U, Ap, An
CLO-IV	Learner will understand Basics of non-linear optics	1	U , Ap, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit –I

Working principle of laser, threshold condition characteristics of laser, Gaussian beam and its properties, optical Resonators, longitudinal and transverse modes of laser cavity, mode selection, gain in a Regenerative Laser cavity.

Rate equations and threshold for 3 and 4 level systems. Q switching, mode locking and obtaing altrashort pulses. Spectral narrowing.

Unit – II

Ruby laser, He-Ne laser, Nd based lasers, semiconductor lasers, Nitrogen laser, CO_2 laser, ion laser Dye laser, chemical laser, excimer laser, Higher power laser systems.

Unit –III

Laser fluorescence and Raman scattering and their use in ranging and pollution studies; ultra high resolution spectroscopy with laser, and its application in isotope separation, single atom detection and rotational and vibrational level of molecules. Optical fibers, use of lasers in light waves communication. Qualitative treatment of medical and engineering applications of lasers.

Unit – IV

Crystal optics, propagation of light in a medium with variable refractive index, Electro, optical effect. Non-linear interaction of light with matter, laser induced multiphoton processes, second harmonic generation phase matching, third harmonic generation optical mixing, Parametric generation of light self focusing of light, Frequency mixing in gases and vapours, Optical bistability and optical phose condugation, Frequency up coversion.

Unit – V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Calculation of threshold population inversion for laser action in a cavity of given parameters.
2. Calculation of gain coefficient.
3. Determining line width of laser line.
4. Determining line pulse duration in case of Q switched or mode locked laser.
5. Calculation of power of the laser output in case of certain laser system.
6. Tuning of laser in order to obtain- a particular wave length
7. Finding distance of an object by laser range finder.
8. Determining vibrational levels of molecule by scattering of laser light.
9. Calculation of intensity of second harmonic and third harmonic generated by non-linear interaction of laser light with matter.
10. Calculate the wave length separation between the longitudinal modes of a 1530 nm semiconductor laser in which the active layer in 0-2 μm long and has a refractive index of 4.0.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

TEXT AND REFERENCE BOOK

- Svelte : Lasers
- Yariv : Optical Electronics.
- Demtroder : Laser spectroscopy

- Letekhov : Non-Linear Laser spectroscopy
- Lasers : A.L. Siegman
- Optical Electronics : K.Tyagrajan & A.K. Ghatak.

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

PAPER II

Elective paper (C) Physics of NanomatErials

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To understand the consequences of confinement effect and classification of nano-materials	U,R
CO-II	To learn about the techniques of fabrication of MQW & SL structures	C
CO-III	To develop an understanding about synthesis and characterization techniques of nano materials	An,Ap
CO-IV	To learn about optical and electrical properties of nano materials	U,E

CO- Course Objectives

Course Learning Outcome

The students are expected to acquire the knowledge of the following:

No.	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will recognize and explain Quantum confinement effect	1,3	R,U
CLO-II	Learner will understand and identify Quantum well and super lattices	4,5	U, Ap
CLO-III	Learner will classify methods of Synthesis	2	U, Ap,

	nanomaterials		An
CLO-IV	Learner will understand characterization techniques and estimate particle size	3,4	U, Ap,
CLO-V	Learner will understand and estimate Optical and electrical properties of nanomaterials	2,3,4	An ,E,C

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit-I

Concept of Quantum Confinement

Free electron theory (qualitative ideas) and its features. Idea of band structure, Metals, insulators and semiconductors, Density of states in bands, Variation of density of states with energy.

Electron confinement in infinitely deep square well, confinement in two and three dimension, Idea of quantum well, quantum wire and quantum dots, classification of nanostructured materials.

Unit-II

Quantum wells and Superlattices

Energy levels and density of states in quantum wells. Band structure in quantum well, coupling between the wells, multiple quantum well structure, superlattice dispersion relation and density of states, Band structure in superlattice, Types of superlattices.

Techniques of Fabrication of MQW and SL structures (MBE, MOCVD, LPE etc).

Unit-III

Nanoparticles

Synthesis of nanoparticles: Bottom up: cluster beam evaporation, ion beam deposition, chemical bath deposition with capping techniques; and Top up: Ball milling.

Physical properties of nanoparticles: Impurities and composition surface roughness, structure, thermodynamic properties. Determination of particle size by width of XRD peaks.

Unit-IV

Characteristics of nanoperticles

Optical properties : Absorption spectra, luminescence, Raman scattering, spectral response. Determination of particle size by shift in photoluminescence peaks.

Electrical properties of nanoparticles, nanostructured magnetic materials, stability of nanocrystals. Application of nanostructured materials.

Unit-V

This unit will have tutorial problems covering all the four units. Some sample problems are:

(1) Density of state function in 1D, 2D and 3D systems.

(2) Calculation of energy levels and change in band gap in a quantum well of given dimensions.

(3) Energy difference between two levels in a double QW.

(4) Variation of specific heat with size of crystal.

(5) Calculation of crystal size from XRD peaks.

(6) Calculation of crystal size from PL peaks.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and References Books

- Nanotechnology Molecularly designed material by Gan-Moog, Chow , Kenneth. E Gonsalves, AmericanChemical Society.
- Quantum dot heterostructure by D. Bimerg, M. Grundmann and N.N. Ledentsov John Wiley and sons 1998.
- Nanotechnology: Molecular Speculations on global abundance by B.C. Gran dall MIT Press 1996.
- Physics of low dimensional semiconductors by John W. Davies, Cambridge Univ. Press 1999.
- Physics of semiconductor nanostructures by K.R. Jain Narosa 1999
- Nano-fabrication and bio-systems: Integrating materials science engineering Science and biology by Harvey C. Hoch, Harold G. Craighead and Lynn Jelinski, Cambridge Univ. Press- 1996.
- Nano particles and nano structured films: Preparation, characterization and application, Ed. J. H. Fendler, Jhon Wiley and sons 1998.
- Wave mechanics applied to semiconductor heterostructures by Gerald Bastard.

Mode of Evaluation: CCE (Digital Assignments, Presentations Class Test, Assignments, etc.) End Semester examination

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

Papers III

Special paper (A) Condensed matter physics – II

Course Objectives

The objective of the course is to develop specialization skill with advance knowledge in the subject.

No.	Course Objectives	Cognitive Level
CO-I	To enable familiarization of the different parameters associated with superconductivity and the theory of superconductivity, idea of high temperature superconductivity	U,R
CO-II	To enable differentiation between point defects, shallow impurity states and color centers	An
CO-III	To enable differentiation between the structure and symmetries of liquids and get acquainted with the idea of quasi crystals	An,Ap
CO-IV	To enable with a knowledge of types of CNT's and its applications	Ap,C
CO-V	To enable understanding about disordered and amorphous solids, Atomic correlation function and structural descriptions of glasses and liquids	U,E

CO- Course Objectives

Course Learning Outcome

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will be able to understand Acoustic, optical phonons and polarons. Theories of Superconductors, Josephson Effect	1	U,

CLO-II	Learner will be able to understand Point defects , Structure and symmetries of liquid crystals and amorphous solids	4	U, Ap
CLO-III	Learner will be able to explain Fullerenes, Three dimensional carbon nanotube structures, Synthesis and characterization of nanostructures materials	2,3,4	U, Ap, An
CLO-IV	Learner will be able to understand Disorder in condensed matter, Anderson model for random systems	1,5	U , Ap, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit – I

Interaction of electrons with acoustic and optical phonons, polarons, Superconductivity : Manifestations of energy gap, Cooper pairing due to phonons, BCS theory of superconductivity, Ginzsburg –Landau theory and application to Josephson effect : d-c-Josephson effect, a-c Josephson effect, macroscopic quantum interference. Vortices and type II superconductors, high temperature superconductivity (elementary).

UNIT – II

Point defects : Shallow impurity states in semiconductors. Localized lattice vibrational states in solids, vacancies, interstitial and colour centers in ionic crystals.

Structure and symmetries of liquids, liquid crystals and amorphous solids. Aperiodic solids and quasicrystals; Fibonaccy sequence, penrose lattice and their extension to 3-dimensions.

UNIT – III

Special carbon solids; fullerenes and tubules, formation and characterization of fullerenes and tubules. Single wall and multi -wall carbon tubules. Electronic properties of tubules. Carbon nanotubule based electronic devices. Definition and properties of nanostructured materials. Methods of synthesis of nanostructures materials. Special experimental techniques for characterization of nanostructured materials. Quantum size effect and its applications.

UNIT - IV

Disorder in condense matter, subsitutional, positional and topographical disorder, short and long range order, Atomic correlation function and structural descriptions of glasses and liquids.

Anderson model for random systems and electron localization, mobility edge, qualitative application of the idea to amorphous semiconductors and hopping conduction.

UNIT - V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Draw diagrams showing some possible two-phonon processes in which a neutron enters with momentum p and leaves with momentum P'. In labeling the diagrams take due account of the conservation law.

2. The average rate of dissipation of energy for an electromagnetic wave is $W = < E.J.>$ where the average is over a complete cycle. Show that

$$W = (\omega\varepsilon_2/ 8\pi)E_o^2 = \sigma E_o^2/2 = \sigma_1 E^2$$

3. How do the (2l+1) fold degenerate energy levels of a free atom split up in a crystal field invariant to all proper rotations which transform a cube into itself ? The free atom is invariant to operations of the (infinite) rotation group. The characters of the irreducible representations of this group are

$$\lambda^{(l)}(\varphi) = \sin (l + ½) \phi/ \sin \phi/2$$

The point group of the crystal field has 24 elements in five classes and hence also five irreducible representations. Set up character table for this group

4. (a) Show whether periodicity can exist together with a periodicity in a structure (b) What is golden mean ratio ? How it is relevant to quasi crystals.
5. Band structure formula for crystals is not quite valid for Nanostructure, why?
6. Distinguish between crystalline, amorphous solids and liquids.
7. What are onion carbon structure ? How are they related with fullerene.
8. Calculate the lifetime of electrons and holes in a semiconductor with recombination centers (acceptors with levels E_R in the energy gap) Treat explicitly the limits of large and small defect concentration n_r. Discuss the recombination mechanism in both cases. Compare the two possible definitions : $\delta n(t) – \exp (-t/ \tau)$ (decay time) and $\delta n = G\tau$ (steady state).
9. The carbon nanotubles can be both semiconducting and metallic why?

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

TEXT AND REFERENCES BOOKS

Crystal Structure Analysis : Burger

The Physics of Quasicrystals, : Eds steinhardt and Ostulond

HAND BOOK OF NANOSTRUCTURED MATERIALS : ED. HARI SINGH NALWA

and Nanotechnology (Vol. l to 4)

Quantum Theory of Solid State : Callaway

Theoretical Solid State Physics : Huang

Quantum Theory of Solids : Kittle

Introduction to Solid State Theory : Madelung

Solid State Physics : J.P. Shrivastava

X-ray Crystallography : Azaroff

Elementary Dislocation theory : Weertman and Weertman

Crystallography for Solid State Physics	:	Verma and Shrivastava
Solid State Physics	:	Kittel
Elementary Solid State physics	:	M. Ali Omar

Mode of Evaluation: CCE (Digital Assignments, Quiz, Class Test, Assignments) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

PAPER IV

SPECIAL PAPER (b) : A Course In COMPUTATIONAL PHYSICS USING MATHEMATICA– II

Course Objectives

The objectives of the course are:

No.	Course Objectives	Cognitive Level
CO-I	To enable students to do simulation of diffraction patterns of a straight edge and single slit and simulation of interference patterns in Newton rings	U,An,Ap
CO-II	To enable to obtain the eigen values and plot the wave functions of a simple harmonic oscillator, particle bound in an infinite potential well. To enable to obtain the energy values of the hydrogen atom as per the Bohr theory	U,R
CO-III	To enable to (1) plot the Energy density/ distribution of energy of Free Electrons in Metals; (2) to do find a numerical solution to the Diffusion/heat equation; (3) plot the Planck formula for blackbody radiation; (4) plot the Phase Plot of a Chaotic non-linear circuit; (5) plot the phase plots of a non linear simple pendulum	C,E
CO-IV	To enable to plot the (1) Frequency Response of LCR circuits; (2) Fermi-Dirac Distribution of Metals; (3) Specific Heat of Solids in the Debye Approximation; (4) simulation of a Random walk; (5) the Richardson Dushman equation	C
CO-V	To enable to do: 1. The graphical depiction of the variation of the diameter of Newton's rings and variation of the square of the diameter of Newton's rings with the order of the rings. 2. The graphical depiction of the Poincare section in the chaotic domain of a non-linear simple pendulum. 3. The graphical depiction of the one-dimensional, Gaussian wave packet	Ap,C,E

	4. The graphical depiction of the of Hermite, Laguerre and LegendreP polynomials by Mathematica 5. The graphical depiction of the Energy Eigen values of a rigid rotator 6. Solution of the Differential Equation of a of a LCR circuit using Laplace Transform. 7. Fourier Analysis 8. Modeling and simulation of a predator and prey problem	

CO- Course Objectives

Course Learning Outcomes

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will be able to Learn how to plan for writing the algorithm for solving a problem by drawing the flowchart of simple problems like roots of quadratic equations etc	1,3	U,
CLO-II	Learner will be able to Have a working knowledge about the Mathematica® system, for example, the necessary commands	4	U, Ap
CLO-III	Learner will be able to Learn, write and run Mathematica® programs. To have hands-on experience on computational tools, students are expected to do the following exercises: (1)to find the roots of a quadratic equation, (2) numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization	2,5	U, Ap, An
CLO-IV	Learner will be able to Simulation of ODE/PDE Models with Mathematica®.Blackbody Radiation:, Current Flow in Forward and Reverse Biased Diode. application to one-dimensional problem-infinite square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions. Debye theories of specific heat of solids. T3 law	3	U , Ap, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

Unit – I

Application of Mathematica to problems in Optics

Generation of Cornu's Spiral. Plot of the intensity – distance curve for: (1) a straight edge, (2) Fraunhofer diffraction at a single slit, (3) Fresnel diffraction at a single slit. Simulation of the diffraction patterns for: (1) a straight edge, (2) Fraunhofer diffraction at a single slit, (3) Fresnel diffraction at a single slit. Simulation of Newton rings for reflected light.

Unit – II

Application of Mathematica to problems in solving in Quantum Mechanics

(1) Solving one dimensional Schrodinger equation for stationary states, (2) Solution of time independent Schrodinger equation for linear harmonic oscillator: Harmonic Oscillator Eigen functions, Harmonic Oscillator wave functions ,(3) Particle bound in an Infinite Potential Well: Energy Eigen values, wave functions.,(4)The Bohr theory and energy levels of the hydrogen atom

Unit – III

Application of Mathematica to miscellaneous areas of interest in Physics

(1) Energy density/ distribution of energy of Free Electrons in Metals, (3) Numerical solution to the Diffusion/heat equation, (3).The Planck formula for blackbody radiation, (4) Phase Plot of a Chaotic non-linear circuit, (5) Study of the phase plots of a non linear simple. pendulum

Unit – IV

Computer Simulation using the Mathematica command Manipulate:

1. Frequency Response of LCR circuits
2. Fermi-Dirac Distribution of Metals,
3. Specific Heat of Solids in the Debye Approximation
4. Random walk
5. Richardson Dushman equation

UNIT - V

This unit will have questions based on tutorial problems covering all the four units. Some sample problems are:

1. The graphical depiction of the variation of the diameter of Newton's rings and variation of the square of the diameter of Newton's rings with the order of the rings.
2. The Poincare section in the chaotic domain of a non-linear simple pendulum.
3. The propagation of free wave packets. The spreading of the one dimensional, Gaussian wave packet can be demonstrated graphically.
4. Plotting of Hermite, Laguerre and LegendreP polynomials by Mathematica.
5. Energy Eigen values of a rigid rotator.
6. Solution of the Differential Equation of a of a LCR circuit using Laplace Transform.
7. Fourier Analysis.
8. Modeling and simulation of a predator and prey problem.

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

SUGGESTED BOOKS AND RESOURCE SITES:

1. Programming in Mathematica: Roman Maeder, Addison Wesley.
2. Mathematica in the Laboratory: Samuel, Dick, Alfred Riddle, Douglas Stein, Cambridge University Press.
3. Introductory Statistics and Random phenomena: Manfred Denker and Wobor A. Woyczynski, Springer (India) Pvt. Limited.
4. Computational Physics: R. C. Verma, P. K. Ahluwalia and K.C. Sharma, New Age Publishers (1999)
5. Ajoy Ghatak, "Optics", 5th edition, Tata McGraw Hill Education Private Limited (2012)
6. Joseph Valasek, "Theoretical and Experimental Optics", John Wiley and Sons, Inc., New York (1949)
7. Francis S. Jenkins, Harvey E. White, "Fundamentals of Optics", 3rd edition, McGraw-Hill Book Company, Inc.(1957)
8. K. D. Moller, "Optics: Learning by Computing, With Examples Using MathCad", Springer-Verlag (2003)
9. Numerical Recipes in C ; Press W.H., Teukolsky S.A. Vellerling W.T. and Flannery B.P. (Cambridge Univ. Press 1992)
10. Simulation using Personal Computers: Carroll, J.M. (Prentice Hall, 1987)
11. www.wolfram.com
12. http://demonstrations.wolfram.com/HeatCapacityOfSolidsInTheDebyeApproximation/
13. http://demonstrations.wolfram.com/PlotsOfTheFermiDiracDistribution/
14. http://demonstrations.wolfram.com/FermiDiracDistributionsForFreeElectronsInMetals/
15. http://demonstrations.wolfram.com/FrequencyResponseOfAnLCRCircuit/

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination.

St. Aloysius' College (Autonomous), Jabalpur

Department of Physics

Under CBCS System

2023-24

M. Sc. IV Semester **Max Marks- 40**

Passing Marks - 14

PAPER IV

SPECIAL PAPER (b) ELECTROINCS – II

Course Objectives

The objectives of the course are :

No.	Course Objectives	Cognitive Level
CO-I	To introduce with various aspects of digital communication	U,R
CO-II	To introduce with noise in digital communication systems	U,An,Ap
CO-III	To introduce with 8086 microprocessor and assembly language progrng	Ap,C, E
CO-IV	To learn about 8086 connection timings, Interrupts, Digital and Analog interfacing	U,Ap

CO- Course Objectives

Course Learning Outcomes

The students are expected to acquire the knowledge of the following:

	Course Learning Outcomes	PSO Addressed	Cognitive Level
CLO-I	Learner will be able to understand Digital communication involving modulation	1	U,
CLO-II	Learner will be able to understand and explain the Concept of noise, networking, Multiplexing	3	U, Ap
CLO-III	Learner will be able to explain Internal architecture and operation of Intel 8086	4	U, Ap, An

	microprocessor ,assembly language		
CLO-IV	Learner will be able to understand and apply Interfacing and interrupts in Intel 8086 system ,elementary idea about Intel 80816, Intel 80286, and Intel 80386 to Pentium processors	2,4,5	U , Ap, E

CLO – Course Learning Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

UNIT-I

Digital Communication

Pulse-Modulation Systems: Sampling theorem- Low pass and Band pass Signals, PAM, Channel Bandwidth for a PAM signal, Natural sampling, Flat-Top sampling, Signal recovery through Holding, Quantization of signal, Quantization, Differential PCM, delta Modulation, Adaptive Delta Modulation, CVSD.

Digital Modulation techniques: BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK, MSK.

UNIT-II

Noise in pulse code and Delta modulation systems: PCM transmission, calculation of Quantization noise, output-signal power, Effect of thermal noise, Output signal to noise ratio in PCM,DM, Quantization noise in DM, output signal power, DM output-signal –to Quantization- noise ratio. Effect of thermal noise in Delta modulation, output signal- noise ratio in DM.

Computer communication systems: Types of networks, Design of a communication network, examples TYMNET, ARPANET, ISDN, LAN.

Introduction to Mobile radio and satellites: Time division multiple Access (TDMA), Frequency Division Multiple Access (FDMA), ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA) Poisson distribution, protocols.

UNIT-III

Introduction to 8086, Microprocessor chip, Internal Architecture, Introduction (Basics of) to Programming of 8086 and Assembly language. Programme development steps. Construction of machine code for 8086 Instructions, writing a programme for use with assembler, Assembly language program development tools.

Assembly Language Programming Technique : Simple sequence programmes. Basic idea of flags and jumps, While – Do, IF- THEN, IF –THEN-ELSE structure based simple programs. Writing and using Assembler Macros.

UNIT – IV

8086 System Connection Timings : 8086 Hardware Review, Addressing Memory and ports in microcomputer system , Basic Idea about Timing parameters, Minimum mode waveform and calculation for access time.

Interrupts : 8086 Interrupts and Interrupts response with some hardware applications.

Digital and Analog Interfacing of 8086 : Methods of parallel data transfer, single Handshake I/O , Double Handshake Data transfer. 8255 Handshake applications : Lathe control and speech synthesizer. Display and keyboard interfacing with 8279, D/A interfacing with microcompiler, A/D interfacing (introduction)

Elementary Idea about 80816, 80286, 80386 to Pentium processors

UNIT - V

This unit will have tutorial problems covering all the four units. Some sample problems are:

1. Explain the meaning of pulse code modulation. Draw one complete cycle diagram. Draw one complete cycle of some irregular waveform and show it is quantized using eight standard pulses.
2. Efficiency of PCM
3. Noise in PCM system
4. Signal to noise ratio in time division multiplexed PAM systems.
5. Program for creating a delay loop using 16 bit register pair.
6. Program for 8086 in Assembly Language using IF-THEN-ELSE structure.
7. Debugging Assembly Language Programs for 8086 μp with simple examples.
8. Assembly Language for interrupts procedure in 8086.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

TEXT AND REFERENCES BOOKS

Principles of communication system : Taub & Schilling (1994) II Edition

Communication systems : Simon Haylein III Ed.

Microprocessors and Interfacing : Douglas Hall 2nd Ed. (1992)
Programming and Hardware

The Intel Microprocessor 8086/8088/ : Brey & Brey
80186/80286/80386/80486 Pentium and
Pentium ProProcessor Architecture
Programming and Interfacing

Mode of Evaluation: CCE (Digital Assignments, Presentations, Class Test, Assignments, etc.) End Semester examination.

ST. ALOYSIUS' COLLEGE (AUTONOMOUS), JABALPUR

DEPARTMENT OF PHYSICS

UNDER CBCS SYSTEM

2023-24

M.SC. (PHYSICS) III & IV SEMESTER: PRACTICAL COURSE

Note: 1. Based on special paper I

2. Appropriate Other Experiments Can Be Added Based On Prescribed Syllabus In Both Labs A And B

LAB –A (CONDENSED MATTER PHYSICS –I & II)

MAX. MARKS: 50

MIN. MARKS: 18

(Preferably five experiments per semester to be performed by the students)

1. To find the Hall Coefficient, Carrier Density and Mobility of the Sample material (Ge).
2. To determine the Resistivity and the Energy Band Gap of Semiconductor (Ge) by Four Probe Method.
3. To find the refractive index of a polymer film and to study the variation of refractive index with wavelength of light source.
4. To find the refractive index of Sugar Solution to study the variation of refractive index with different molar concentration (Using Green Laser).
5. To determine the Plateau and optimal operating voltage of a GM Counter.
6. Determination of Beta Particle range and maximum Energy (by Half Thickness Method).
7. To Study the Variations of Counter rate for different materials (absorber of same thickness) with constant voltage.
8. To verify the Lambert – beer's law for different Concentration of $KMnO_4$ Solution using Spectrometer.
9. To Analyze material qualitatively using an FTIR Spectrophotometer.
10. To Measure the magnetic Susceptibility of $FeCl_3$ solution by Quincke's Method.
11. To find the crystallite size of Sample (CdS powder) using X-ray Diffractometer.
12. To find the miller indicies (hkl) of Sample (Known/Unknown) using X-ray Diffractometer.
13. To study crystal symmetry using Crystal model.
14. To measure the absorbance of different material using Spectro photometer.
15. Study of the dispersion relation for the monoatomic lattice- comparison with the theory.
16. Determination of the cut off frequency of the monoatomic lattice.
17. Study of the Dispersion relation for the diatomic lattice- acoustical mode and optical mode energy gap. Comparison with theory.

ST. ALOYSIUS' COLLEGE (AUTONOMOUS), JABALPUR

DEPARTMENT OF PHYSICS

UNDER CBCS SYSTEM

2023-24

M.SC. (PHYSICS) III & IV SEMESTER: PRACTICAL COURSE

Note: 1. Based on special paper II

2. Appropriate Other Experiments Can Be Added Based On Prescribed Syllabus In Both Labs A And B

LAB –B (MATHEMATICA –I & II)

MAX. MARKS: 50

MIN. MARKS: 18

(Preferably five experiments per semester to be performed by the students)

Analysis and Simulation of the following problems in Physics using Mathematica.

Addition and deletion of exercises can be done as per the need.

1. Write and execute a program to calculate and print roots of a quadratic $ax^2+bx+c = 0$ ($a \neq 0$) .
2. Write and execute a program in Mathematica to add and multiply two matrices.
3. Write and execute a program in Mathematica to determine the Eigen value of matrices.
4. Write and execute a program in Mathematica to determine the Eigen vector of matrices.
5. Converting graphics into 'jpeg' format. Exporting of images in 'jpeg' format.
6. Using DSolve to solve a differential equation and using Extract to obtain the solutions.
7. Using DSolve to solve a differential equation and plotting the solutions.
8. Study of " Harmonic Motion :- mx"+cx'+sx = 0";"c^2-4mk>0 , overdamped; c^2-4mk=0, critically damped; c^2-4mk<0, underdamped";
9. Phase Plot of a system undergoing linear Oscillations.
10. Potential Energy and Kinetic Energy diagram of the Linear Harmonic Oscillator.
11. Resonance Plots of a LCR circuit.
12. Study of Charging and Discharging in circuits with inductors, capacitors and resistors
13. Plot of the intensity – distance curve for a straight edge.
14. Plot of the intensity – distance curve for Fraunhofer diffraction at a single slit.
15. Plot of the intensity – distance curve for Fresnel diffraction at a single slit.
16. Simulation of the diffraction patterns for a straight edge.
17. Simulation of the diffraction patterns for Fraunhofer diffraction at a single slit.
18. Simulation of the diffraction patterns for Fresnel diffraction at a single slit.
19. Simulation of Newton rings for reflected light.
20. Obtaining the Energy Eigen values of a Particle bound in an Infinite Potential Well and plotting of the wave functions.
21. Obtaining the Energy Eigen values of the hydrogen atom by applying the Bohr theory and plotting of the energy level diagrams.

22. Computer Simulation of the Frequency Response of LCR circuits.
23. Computer Simulation of the Fermi-Dirac Distribution Plots of Metals.
24. Modeling and simulation of a predator and prey problem.

LAB –B (ELECTRONICS –I & II)

(Preferably five experiments per semester to be performed by the students)

1. Amplitude Modulation and Demodulation.

2. TDM PULSE Amplitude Modulation and Demodulation.

3. Study of PCM Receiver and Transmitter.

4. Study of satellite – C Band Receiver.

5. Study of AM – FM Receiver set.

6. Pulse position/ Pulse width Modulation and Demodulation.

7. FSK Modulation.

8. Microwave characterization and measurement.

9. Study of Motor speed control Interface and programming.

10. Temperature control using 8086.

11. Programs for Addition, Division, Subtraction, & Multiplication with 8085 μp system.

12. Programs for (using 8085) (a) To find Largest Number.

(b) To find Smellers Number

13. Programme for Addition, Subtraction, Multiplication and Division with 8086.

14. Dielectric measurement of Solid/Liquids using Microwave.

15. SWR Reflection Coefficient Measurement.

16. Study of E Plane , H Plane, Magic Tees Bends.

17. Frequency Guide wavelength measurement.

SYLLABUS

PG

COMPUTER SCIENCE

St. Aloysius College(Autonomous), Jabalpur
Semester I
Core Paper- CS102T
Subject: Software Engineering and Modeling

			Theory		Internals	
Lectures/Unit	Credits		Max	Min	Max	Min
14	T	P	40	16	10	5
	4	0				

UNIT I

Software Processes: Define Software Engineering, Processes, Process Models, projects and products, component software processes, characteristics of a software process, software development process, project management process. Software requirement Analysis and Specification: Software requirement, need for SRS, characteristics of an SRS, component of an SRS, structure of requirement document validation, requirement reviews.

UNIT II

Planning Software Project: Cost estimation, uncertainties in cost estimation, building cost estimation models, on size estimation, COCOMO model, project scheduling, average estimation, project scheduling and milestones, staffing and personnel planning, team structure, software configuration management plans, quality assurance plans, verification and validation, project monitoring plans, risk management.

UNIT III

Function Oriented Design: Design principles, coupling, cohesion, design notation and specification, structured design methodology, verification, network metrics, stability metrics, information flow metrics. OO Modeling Concepts, Class Modeling- Object and class concepts, Link and association concepts, generalization and inheritance, Advanced class modeling-Concepts, association ends, N-ary associations, aggregation, abstract classes, multiple inheritance. State Modeling- Events, states, transitions and conditions, concurrency, interaction Modeling- use case models, sequence models, activity models.

UNIT IV

Testing Methods: Software testing fundamentals, test case design, white box testing, control structure testing, black - box testing, testing for specialized environments. **Software Testing Strategies:** A strategic Approach to software testing, strategic issues, unit testing, validation testing, system testing, the art of debugging.

UNIT V

Re-Engineering: Software re-engineering, software maintenance, software reengineering process model, reverse engineering, reverse engineering user interfaces restructuring, code restructuring, data restructuring, forward engineering the economics of reengineering. **Client / Server software Engineering:** The structure of Client/server systems, software engineering for c/s systems, analysis modeling issues, design for c/s systems, testing issues. **Computer-Aided software Engineering:** What is case, building blocks for case, taxonomy of case tools, integrated case environments, the integration architecture, case repository.

Textbooks:

Software Engineering, A Practitioners Approach Tata Mc Graw hill by Pressman Rogers

Reference Books:

An Integrated Approach to Software Engineering by Pankaj Jalote.
Software Engineering Concepts by R.E. Fairly, Mc Graw Hill.
Software Project Management by Boyce

Semester-I
Core Paper- CS105T
Subject- Java with GUI and web technologies

			Theory		Internals		Practical	
Lectures/Unit	Credits		Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course objective:

- To understand the concepts and features of object-oriented programming.
- To examine key aspects of java Standard API library such as util, io, applets, swings, GUI based controls.
- To learn java's exception handling mechanism, multithreading, packages and interfaces.
- To develop skills in internet programming using applets and swings.
- To develop skills of client-side scripting.
- To familiarize the student with client server architecture and development of web application using Java technologies. Students will gain the skills and project-based experience needed to enter into Web Application and Development careers.

Course Outcome:

The students will be able to comprehend classical problems using Java Programming, implement frontend and backend of an application and also build real world applications.
They will be able to write a well formed / valid XML document, can establish connectivity to database, and perform Server-Side application using JSP and Servlet.

UNIT-I

Introduction of Java, **Applet Class:** Life Cycle of an Applet, The Applet Tag and their attributes, Passing Parameter to an Applet, Graphics in Applet. **AWT:** Event Handling: Event Handling Mechanism, the Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces.

UNIT-II

AWT controls, Adapter Classes, Layout Managers and Menus.
Swings: JButton, JLabel, JTextField, JTextArea, JPasswordField, JCheckBox, JRadioButton, JComboBox, JTable, JList, JScrollBar, JMenuItem & JMenu, JPopupMenu , JCheckBoxMenuItem , JTree , JTabbedPane , JPanel , JFrame, JScrollPane.

UNIT-III

Java Database Connectivity(JDBC): Introduction, JDBC Driver, DB Connectivity steps, Connectivity with Oracle, MySQL and MS Access, Connection Interface, Statement Interface, ResultSet Interface, PreparedStatement.

UNIT-IV

Servlet: Servlet API, Servlet interface, GenericServlet class, HttpServlet class, Life Cycle of a Servlet, ServletRequest Interface, RequestDispatcher interface, ServletConfig Interface, ServletContext Interface, cookies, hidden form field, HttpSession.
Data Access with Servlets: Connecting to a Database, Retrieving Data.

UNIT-V

JSP Overview: JSP- Life Cycle: JSP Compilation, JSP Initialization, JSP Execution, JSP Cleanup. **JSP Syntax:** The Scriptlet, JSP Declarations, JSP Expression, JSP Comments, JSP Directives, JSP Actions, JSP Implicit Objects, Control Flow Statements, Decision Making Statements, Loop Statements, JSP Operators, JSP Literals**, JSP Directives, JSP- Client Request:** The HttpServletRequest Object, HTTP Header Request Example. **JSP- Server Response:** The HttpServletResponse Object, HTTP Header Response Example. **JSP Form Processing:** GET method, POST method, Reading Form Data using JSP.

Text Books:

- The Complete Reference: Java 2 – 5Ed, Herbert Schildt, Tata McGraw-Hill Publishing
- Company Limited.
- Java Servlet Programming Bible, S. Rajagopalan, R. Rajamani, R. Krishnaswamy, and S. Vijendran, WILEY dreamtech India Pvt. Lmt.
- The Complete Reference: Java 2 – 5Ed, Herbert Schildt, Tata McGraw – Hill Publishing Company Limited.

Reference Books:

- Java Examples in a Nutshell - by David Flanagan
- The Java AWT Reference by John Zukowski Publisher: O'Reilly & Associates, Inc.
- The Java Class Libraries: An Annotated Reference by Patrick Chan, Rosanna Lee
- Publisher: Addison-Wesley
- Designing Better Apps and Applets with Java by Peter Coad, Mark Mayfield
- Java Servlet Programming Bible
- Database Programming with JDBC and Java - by George Reese

Practical List

- Calculate area of circle, rectangle and triangle using method overloading.
- WAP to demonstrate the concept of multilevel inheritance.
- WAP to demonstrate object cloning.

1. WAP to demonstrate WAP to demonstrate use of super keyword.
2. WAP to demonstrate use of this keyword.
3. WAP to demonstrate use of inner class.
4. WAP to demonstrate use of static keyword.
5. WAP to demonstrate multiple inheritance using interface.
6. WAP to run multiple threads at a time.
7. WAP to demonstrate use of user defined Package.
8. WAP to demonstrate thread synchronization.
9. WAP to demonstrate Layout managers.
10. WAP to demonstrate adapter classes.
11. WAP to create registration form with proper layout.
12. WAP to demonstrate login form.
13. Create a servlet that prints today's date.
14. Create a servlet for a login page. If the username and password are correct then it says message "Hello <username>" else a message "login failed".
15. create a servlet that uses Cookies to store the number of times a user has visited servlet.
16. Create a servlet that displays some header information from your request as well as any form data.
17. Create a servlet filter that changes all text to upper case.
18. Create a JSP that prints current date and time.
19. Create a JSP that adds and subtracts two numbers.
20. Create a JSP that prints odd numbers that come within a range.
21. Create a JSP for login module.

Semester-I
Core Paper- CS103T
Subject: Information Security

			Theory		Internals	
Lectures/Unit	Credits		Max	Min	Max	Min
14	T	P	40	16	10	5
	4	0				

Course Objectives:

- Aware and Understand the Challenges and Scope of Information Security.
- Gain the Knowledge of Basic Security Concepts.
- Learn and Understand the Importance of Cryptographic Algorithms and Their Uses.
- Learn and Understand Access Control Mechanism Used for User Authentication and Authorization.

Course Outcome:

1. Principles of Cryptography and Cryptanalysis Including Symmetric and Asymmetric Encryption Hashing and Digital Signatures.
2. Identify and Classify Particular Examples of Attacks.
3. Implement the Various Security Algorithms.
4. Analyze the Root Causes of Attacks & Suggest Appropriate Solution for Different Types of Security Breach Scenario.

Unit I :Security Taxonomy, Domain of information security, security goals, security approaches, principles of security, security attacks, threats, vulnerabilities, malicious software's, virus, worms, Trojan, spy wares, Applets/Active X, cookies. Security services, mechanisms and security models. Types of attacks, packet sniffing, packet spoofing, IP sniffing, IP spoofing, DNS spoofing attack.

Unit II : Cryptography terminologies, classical cryptography: substitution techniques, transposition techniques, playfair cipher, Hill cipher. Mathematics of cryptography: Integer arithmetic, modular arithmetic, Elucid theorem, Concept of symmetric and asymmetric key cryptography, stenography, digital watermarking, key range and size, possible types of attacks. Stream ciphers and Block cipher. Algorithm type and modes. Key distribution, Deffie Hellman key exchange, Man in the middle attack.

Unit III:Computer based symmetric key cryptographic algorithms: Data Encryption Standard (DES), Double DES, meet in the middle attack, Triple DES, International Data Encryption Algorithm (IDEA), RC5, Blowfish, Advance Encryption Standard (AES).
Unit IV:Random number generation, Prime numbers. Fermat's and Euler's theorem. Principles of public key crypto systems. Computer based asymmetric key cryptographic algorithms: RSA algorithm. Principles of public key cryptosystems, symmetric and asymmetric key cryptography together. Concept of Digital Envelope, Digital signatures, message digests and its requirements.

Unit V : Asymmetric Key Cryptosystems : MD5 Message Digest Algorithm, Message authentic codes, Hash functions, Secure Hash Algorithms, Hash based message authentic code. Elliptical Curve Cryptography (ECC). Problems with the public key exchange.

Text books

1. William Stallings Cryptography and Network Security PHI.
2. Bruce Schneier- the Mathematics of Encryption- American Mathematical Society
3. Atulkahate "Cryptography and Network Security" TMH.
4. Calabrese Info Security Intelligence-Cryptography Principles Appl- Cengage Learn.

Semester II

Computer Science Elective Paper- CS205T
Subject: Big Data Analytics

			Theory		Internals		Practical	
Lectures/Unit	Credits		Max	Min	Max	Min	Max	Min
14	T	P	40	14	10	4	33	12
	4	2						

Course Objective: The aim of this course is to give understanding of Big Data, its security provision, concepts of Hadoop, different techniques and tool used in Hadoop, MapReduce, HBase, Deployment process, Data Manipulation, Joins etc.
Course Outcome: Student will be able to learn concepts of Big Data, application methods of Big data analytics in industry, social networking, different software used for data analysis, installation and configuration of tools.

Unit- 1: Data Analytics, Types, Phases, Quality and Quantity of data, Big Data Introduction , Data Storage and Analysis, Comparison with Other Systems, Grid Computing, Volunteer Computing, web analytics, application domain of big data , big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Unit- 2: Introduction to NoSQL, aggregate data models, aggregates, key, value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, version, Map reduce, partitioning and combining, composing map, reduce calculations.

Unit- 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file, based data structures.

Unit- 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map, reduce, YARN, failures in classic Map, reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

Unit- 5: Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, cassandra examples, cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries, case study.

Text Books and Reference Books:
Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilley, 2012.
Eric Sammer, "Hadoop Operations",1st Edition, O'Reilley, 2012.
Essential Reading / Recommended Reading
Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
Alan Gates, "Programming Pig", O'Reilley, 2011.

Semester III

Open Elective Paper-OE305T
Subject: Cyber Security

			Theory		Internals	
Lectures/Unit	Credits		Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course Objective: Cyber security is one of the greatest challenges of contemporary society, and it will only become more complicated as we progress therefore the depth of knowledge and wealth of skills required to engage with and overcome these challenges. Cyber security comprises technologies, processes and controls that are designed to protect systems, networks and data from cyber-attacks. Effective cyber security reduces the risk of cyber-attacks, and protects organizations and individuals from the unauthorized exploitation of systems, networks and technologies.

Course Outcome: The study of Cyber Security helps to gather and analyze data, and learn techniques to accurately present and communicate findings. It aims to empower and enhance proficiency in cyber security among learners and provides guidance on cyber security trends, industry best practices, protective measures against cyber threats, and more. A solid cyber security foundation will identify technology gaps and propose the appropriate action to take to mitigate the risk of an attack. This provides organizations the confidence to build their cyber security strategies.

UNIT-I: Cyberspace, Information Security, Introduction of Cyber Crime, definition, origin, Cybercriminals- hungry for recognition, not interested in recognition, the insiders, cyber terrorism, Challenges of cybercrime.

UNIT-II : Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Cyber-defamation , Internet Time Theft, Salami attack/Salami Technique, Data Diddling, Web Jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime.

UNIT-III: Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackleCyber Crime and Trends.

UNIT-IV: Cyber-offenses: categories of cybercrime, Attacks- passive attacks, active attacks, cyberstalking, stalkers, types of stalkers, Botnet, case studies - Ransomware Aftershock: The Road To Recovery After A Cyber Data Hijack, Cyber Security Protects Sensitive Data

UNIT-V: Tools and Methods in Cybercrime: Proxy Servers and Anonymizers, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks , Buffer and Overflow, Attack on Wireless Networks, Phishing : Method of Phishing, Phishing Techniques, Cyber Detox.

Text Books:

- Data & Network Communication by Michael A. Miller
- Data Communications and Networking, B.A. Forouzan, Tata McGraw-Hill.
- Principles of Cyber crime, Jonathan Clough Cambridge University Press
- John R. Vacca, Computer Forensics:Computer Crime Scene Investigation, 2nd Edition, Charles

RiverMedia, 2005

- Cyber Law Simplified, VivekSood, Pub: TMH.
- Cyber Security by Nina Godbole, SunitBelapure Pub: Wiley-India
- Information Warfare: Corporate attack and defense in digital world, William Hutchinson, MathewWarren, Elsevier.
- Cyber Laws and IT Protection, Harish Chander, Pub:PHI.

Semester IV
Computer Science Elective Paper- CSE403T
Subject: Cloud Computing

			Theory		Internals	
Lectures/Unit	Credits		Max	Min	Max	Min
14	T	P	40	14	10	4
	4	0				

Course objective: The objective of this course is to familiarize the student with cloud environment, building software systems and components that scale to millions of users in modern internet, cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas and MCC.
Course outcome: The student will understand the key dimensions of the challenge of Cloud Computing. They will understand services provided by cloud computing, implementation of open cloud, implementation of Small and Medium Businesses, authentication, authorization & accounting (*AAA*) and Mobile Cloud Computing.

UNIT-I: Era of Cloud Computing (CC): introduction, cloud and other similar configurations, CC vs. peer-to-peer architecture, CC vs. client-server architecture, CC vs. GC, components of CC, impact of CC on businesses. Introduction Virtualization: Introduction, virtualization benefits, implementation levels of virtualization, virtualization at the OS level, virtualization structure, open source virtualization technology, Xen virtualization architecture, binary translation with full virtualization, para-virtualization with compiler support, virtualization of CPU, memory, I/O devices, hardware support for virtualization, virtualization in multicore processors. Cloud Computing Services: IaaS, PaaS, leveraging PaaS for productivity, guidelines for selecting a PaaS provider, concerns with PaaS, languages and PaaS, SaaS, DBaaS.

UNIT-II: Cloud Computing and Business Value: key drivers for CC, CC and outsourcing, types of scalability, use of load balancers to enhance scalability, variable operating costs using CC, time-to-market benefits of CC, distribution over the internet, levels of business values from CC. Cloud Types and Models: private cloud, public cloud, hybrid cloud. Open Source Cloud Implementation and Administration: Eucalyptus& OpenSatck cloud architectures, CSB (158) Recent Trends in Cloud Computing and Standards: conflicts of interest for public cloud and IT product providers, BYOD and encryption exposures, cloud standards, cloud ratings, CC trends that are accelerating adoption.

UNIT-III: Host Security in the Cloud: security for virtualization products, host security for SaaS, PaaS, IaaS. Data Security in the Cloud: challenges with cloud data and data security, data confidentiality and encryption, data availability, data integrity, CSGs. Cloud application requirements, SOA for cloud applications. Adoption and Use of Cloud by Small and Medium Businesses: place of adoption, benefits, adoption phases, vendor roles and responsibilities, selection phases, provider liability, provider capabilities, success factors for CC Adoption process of public clouds by enterprises. Cloud migration techniques, Phases during the migration of an application to the cloud. IT Service Management for Cloud Computing: ITIL based service management, service strategy, service design, service transition, service operations, continual service improvement.

UNIT-IV:SLA with Cloud Service Providers: concept, aspects and requirements of SLA, credit calculation, samples 1 and 3. Risks, Consequences, and Costs for Cloud Computing: introduction, risk assessment and management, risk of vendor lock-in, loss of control, not meeting regulatory compliances, resource scarcity, multitenant environment, failure, inadequate SLA, malware and internet attacks, management of cloud resources, network outages, in fracture, legal, licensing, TCO, cloud costs, cost allocations, chargeback models and methodology, billable items. AAA Administration for Cloud: AAA model, single sign0on for clouds, industry implementation for AAA, authentication management in the cloud, SAML, authentication for resource utilization.

UNIT-V: Security as a Service: benefits of security as a service, concerns with security as a service, security service providers, IdMaaS, attributes of IdMaaS providers.Cloud Certifications and Audits: certifications, cloud audit framework, cloud auditing requirements.Application Security in the Cloud: cloud application SDLC, cloud service reports by providers, application security in IaaS, PaaS and SaaS environments. Mobile Cloud Computing (MCC): Architecture of MCC, benefits of MCC, MCC challenges.

Text Books:

Kailash J, Jagannath K, Donald J H, Deven Shah,Cloud Computing – Black Book

Reference Books:

1. Rajkumar Buyya, Cloud Computing: Principles and Paradigms
2. Arshdeep Bahga, Vijay Madisetti, Cloud Computing – A Hands-On Approach
3. David E.Y. Sarna, Implementing and Developing Cloud Computing Applications
4. Kai Hwang, Distributed and Cloud Computing From Parallel Processing to Internet of Things

SYLLABUS

PG

MICROBIOLOGY

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
FIRST SEMESTER
Session 2023-24

Paper I: Bacteriology **M.M:40**

Course Outcome

On completion of this course, the learners -
CO 1- will learn the basics of bacteriology like History and scope; bacterial structure, physiology and functions.
CO 2- Will be equipped with skills in bacteriological techniques including microscopy, staining techniques, preparation and use of culture media, various means of sterilization, methods for identification of unknown bacteria and various methods of bacterial growth measurement.
CO 3- will be applicable in identifying the bacterial pathogen.

UNIT-I

History, scope and development of bacteriology, sterilization, isolation, enrichment, pure culture and staining techniques, systematic study of bacteria; morphological, physiological, biochemical and serological studies, genetic characterization, identification & classification chart. Eminent women microbiologists

UNIT-II

Habitat, structure, reproduction & classification of bacteria (morphological, biochemical, serological, chemical and molecular aspects), Actinomycetes, *Mycoplasma, Rickettsiae, Chlamydiae* and their significance.

UNIT-III

The photosynthetic bacteria; cyanobacteria, green bacteria, halobacteria and their economic importance. Methanogenic bacteria and their significance. Chemoautotrophs and Methylotrophs; nitrifying bacteria, sulfur oxidizers, iron bacteria, hydrogen bacteria and their economic importance.

UNIT-IV

Enterobacteriaceae and related organisms, their morphological & physiological characters, genetic interrelationship, taxonomic sub-division & their importance in human health. Myxobacteria, cytophage group, filamentous & gliding chaemoheterotrophs & filamentous sulphur oxidizing bacteria.

UNIT-V

Gram positive spore forming bacteria; unicelluar endospore formers- *Bacillus, Clostridia.*
Miscellaneous bacteria; lactic acid bacteria, Micrococci, Corynebacteria, Mycobacteria.
Biofilms.

List of Recommended Books

- Sneath, P.H.A .and R.R. Sokal 1973 Numerical taxonomy .The Principles and Practice of Numerical Classification, San Francisco. W.H. Freeman
- Sneath, P.H.A 1989 Analysis and Interpretation of sequence data for bacterial Systematic. The view of a Numerical taxonomist .Syst.Appl.Microbiol.12:15-31
- Tom Parker, M. Lerline, H.Collier,1990,Principles of Bacteriology, Virology and Immunity, VIII Ed.
- Balows, A.A.G. Thuper, M. Dworker, W. Harder, K.Schleifer 1991 The Prokaryotes, Springer,
- VerlogGunsales and Stainer, The Bacteria I-V vol. Academic press
- Prescott, L.M., J.P Harley and D.AKlein, 2007 Microbiology VII Ed. Mc Grow Hill,
- Davis R.Y. E.A. Adeberg and J.L. Ingram,1991 General Microbiology
- Stainer General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
- Schaechter.R. and Ledenberg.J 2004 The desk encyclopedia of microbiology. Elsevier Acad. Press California.
- Brun,Y.V. and Schinketes 2000 Prokaryotic developments ASM press
- Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
- Talaro, K.P. and A. Talaro 1999 Foundations in Microbiology. Mc Graw Hil. Pub.
- Davies et al.,1990 Microbiology 4thEdition Philadelphia, JB Lippincott

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Practical List

M. Sc. I semester

Session 2023-24

Paper I: Bacteriology

Suggested list of Practicals:

1. Isolation and enumeration of bacteria from air, water and soil
2. Isolation of bacteria on selective media.
3. Staining techniques: Gram staining, simple staining, Endospore staining
4. IMVIC tests (Indole, methyl red, Voges prausker and citrate test)
5. Biochemical test for bacterial identification: Oxidase test, Gelatinase test, Catalase test
6. Isolation of Bacteria from curd by streaking method.
7. Effect of temperature on bacterial growth.
8. Effect of pH on bacterial growth.

Innovative practical:

9. Isolation of bacteria from cell phones.
10. Soap survey to check effectiveness w.r.t bacteria.

Paper II: Virology

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Paper II: Virology **M.M:40**
Session 2023-24

Course Outcome

On completion of this course, the learners -

CO 1- will learn architecture of viruses, their classification, interaction between viruses and their host cells and viruses as tools for various experiments in molecular biology and genetics.

CO 2- get acquainted with techniques of isolating, purifying and culturing viruses as well as the role of viruses in oncogenesis.

CO 3- Will be enriched in virological aspects the students can contribute in preventing and treating viral infections

UNIT-I

General virology: History and development of virology, origin, distinctive properties, ultrastructure and chemistry of viruses. virus related agents (viroids, prions), significance of viruses.

UNIT-II

General methods for isolation, identification, characterization and cultivation of viruses: Methodology for isolation, adsorption, One-step growth and burst size of virus. Determination of titre value, isolation of phage resistant strain, cultivation and maintenance of plant, animal and bacterial / cyanobacterial viruses. identification of viruses by physical, chemical and serological techniques.

UNIT-III

Bacterial/ cyanobacterial viruses: Structure and multiplication of lytic and lysogenic bacteriophage. Significance of lysogeny. Brief account of M13, Mu, T4 and λ, history, structure, genetics and life cycle of cyanophages, significance of bacteriophages and cyanophages.

UNIT-IV

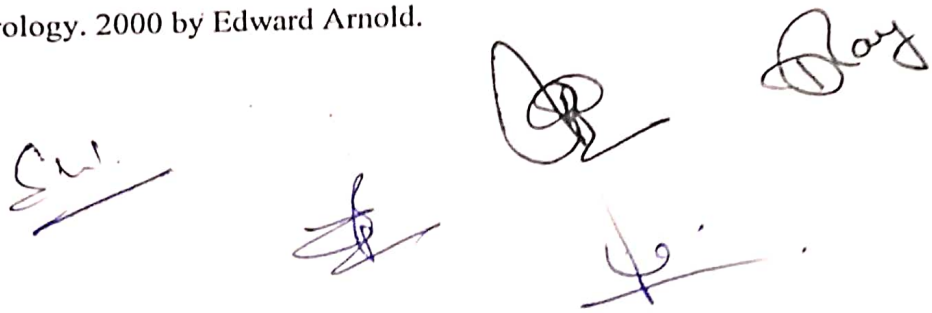
Plant viruses: classification and nomenclature, structure and multiplication of plant viruses with special reference to TMV, cauliflower mosaic virus, effect of viruses on plants. Some common viral diseases of plants (TMV, CMV, leaf Curl of papaya). Transmission of plant viruses and control of viral diseases of plants.

UNIT-V

Animal viruses: Classification and nomenclature of animal and human viruses. Brief account of Adeno-, Herpes, Hepatitis, HIV and other oncogenic viruses. Prevention, treatment and control of viral diseases. Viral vaccines including DNA vaccines and interferons.

List of Recommended Books

- Medical Virology 10 Th Edition by Morag C and Tim bury M C 1994. Churchil Livingstone, London.
- Introduction to Modern Virology 4th Edition by Dimmock N J, Primrose S. B. 1994. Blackwell Scientific Publications. Oxford.
- Virology 3rd Edition by Conrat H.F., Kimball P.C. and Levy J.A. 1994. Prentice Hall, Englewood Cliff, NewJersey.
- Text Book on Principles of Bacteriology, Virology and Immunology Topley and Wilsons 1995.
- Molecular Biology, Pathogenesis and Control by S.J. Flint and others. ASM Press, Washington, D.C.
- Applied Virology. 1984. Edited by Edonard Kurstak. Academic Press Inc.
- Introduction to Modern Virology by Dimmock.
- Prion diseases by Gaschup, M.H.
- Clinical virology Manual by Steven, S., Adinka, R.L., Young, S.A.
- Principles of Virology. 2000 by Edward Arnold.



Paper II: Virology

Suggested list of Practicals

1. Estimation of chlorophyll in healthy and viral diseased plants.
2. Specimen preparation of plant materials with symptoms of viral infection.
3. Study of Viral diseases- leaf curl of papaya and TMV.
4. Isolation of phages from sewage.
5. Preparation of phage lysate.
6. Estimation of proteins in healthy and viral diseased plants.
7. Transmission of viruses by vegetative propagation.

Innovative practical:

8. To collect plant specimens with symptoms of viral infection
9. Identification of embryonated chick eggs

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Paper III: Mycology **M.M:40**
Session 2023-24

Course Outcome:

On completion of this course, the learners -

CO 1- Will gain knowledge of Basic morphology, physiology, classification, genetics and methods for identifying fungi,

CO 2- Will attain a training in laboratory techniques used in isolation, culturing, staining and identification of various fungi

CO 4- Will be equipped with the world of mycology for their future career.

UNIT-I

Status of fungi in the living world, general features of fungi and fungus like organisms; recent trends in the classification of fungi; physiology and growth of fungi; nutritional and environmental factors affecting growth; saprotrophs, parasites and mutualistic symbionts; physiology of reproduction in fungi, phylogeny of fungi.

UNIT-II

Fungal diversity-major taxonomic group, structure, reproduction, life cycle and significance of the following representatives:

i) Gymnomycota-general account – cellular slime moulds (*Dictyostelium*), plasmodial slime moulds (Myxomycetes).

ii) Mastigomycota- *Coelomomyces, Lagenidlum, Achlya, Phytophthora, Peronospora, Plasmodiophora.*

iii) Amastigomycota- Zygomyocotina- *Mucor, Syncephalastrum, Blakeclea, Cunninghamella, Entomophthora.*

UNIT-III

Fungal diversity contd. structure, reproduction, life cycle and significance of the following representatives:

i) Ascomycotina- *Taphrina, Emericeilla, Chaetomium, Morchella, Neurospora, Claviceps, Erysiphae.*

ii) Basidiomycotina- *Puccinia, Melamspora, Ustilago, Polyporus, Lycoperdon, Ganoderma,*

iii) Deutromycotina- *Fusarium, Cercospora, Curvularia, Beauveria, Microsporum, Phoma, Collectotrichum.*

UNIT-IV

Fungal genetics:

i) Life cycle and sexual process in fungi; structure and organization of fungal genomes (mitochondrial genes, plasmids and transposable elements, virus and viral genes).

ii) Genetic variations in fungi- nonsexual variations-haploidy, heterokaryosis, parasexuality; sexual variations- mating or breeding systems- homothallism and heterothallism, mutation, physiological specialization; strain improvement.

UNIT-V

Fungi and biotechnology: production of alcoholic beverages, antibiotics, organic acids, ergot alkaloids; the cultivation of fungi for food-mushrooms, mycoprotein and mycofoods; role of fungi in agriculture and forestry- mycorrhizae and their application, mycopesticides, mycotoxins, conservation of fungal germplasm.

List of Recommended Books

- Tortora, G.J., Funke, B.R. and Case, C.L. 2001. Microbiology: An Introduction. Addison Wesley Longman,
- New York.
- Brock Biology of Microorganisms: by Madigan, Mortinko and Parker (2000), Prentice Hall.
- Microbiology: by Prescott, L.M., Harley, J.P. and Klein, D.A. (1992). WCB Publishers.
- Introductory Mycology: by Alexopoulos, C.J. Mims, C.W. and Blackwell, M. (1996). John Wiley & Sons.
- An Introduction to Fungi: by Webster, J. (1985). Cambridge Univ. Press
- Alexopoulus, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons, Inc.
- Mehrotra, R.S. and Aneja, R.S. 1998. An introduction to Mycology. New Age Intermediate Press.
- Webster, J. 1985. Introduction to Fungi. Cambridge University Press

Paper III: Mycology

Suggested list of Practicals

1. Identification of fungi by slide culture.
2. Preparation of wet mount slide.
3. Measurement of fungal growth by mycelia dry weight estimation.
4. Study of permanent slide of fungi.
5. Lactophenol and cotton blue mounting of fungi.

Innovative practical:

6. Antagonistic activity of fungi

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Elective Paper
Session 2023-24

Paper IV: BIOMOLECULES **M.M:40**

Course Outcome:

On completion of this course, the learners -

CO 1- Gets the Knowledge of fundamental biochemistry like biomolecules and their role in biological systems, laws of thermodynamics and their application to biological systems.

CO 2- gets analytical skills for identifying biomolecules, enzymatic reactions and their regulation.

CO 3- are enabled to perform and assess biochemical tests required during the disease diagnosis.

UNIT I

Structure of water and its solvent properties, Acid- bases, pH and buffer, Bi and polyprotic buffer. Free energy and spontaneity of reactions, ATP and other phosphorylated compound with their free energy of hydrolysis, Phosphoryl group transfer, Biological oxidation reductions reaction, Coupled reaction and oxidative phosphorylation, Inhibitors and uncouplers.

UNIT II

Enzyme classification, Specificity, Active site, Enzyme kinetics, Michealis Menton equation, Determination of kinetic parameters, Bi-substrate reaction and their kinetics, Enzyme inhibition and kinetics, Allosteric enzyme. Kinetics and Allosteric regulation of phosphofructo kinase

UNIT III

Structure and chemistry of macromolecules, Proteins, Carbohydrates and Lipids, Protein folding, Structure and chemistry of biomolecules such as antibiotics, Pigments, Vitamins as coenzymes, Lipid analysis by GLC and Mass Spectrometry, Oligosaccharide and Polysaccharide analysis.

UNIT IV

Biosignaling molecular mechanism of signal transduction, Gated ion channels, Nicotinic acetyl choline receptor, Receptor enzyme, The insulin receptor, G- proteins and cyclic AMP membrane transport, Biomembrane, Nutrient transport across membranes, Active and passive diffusion, Symport, Antiport and uniport, Na^+ K^+ pumps and their metabolic significance.

UNIT V

Chromatographic technique, Paper and TLC , Gel filtration, Ion exchange, Affinity, HPLC, SDS, PAGE, Isoelectric focusing, Western blotting, Protein sequencing, Mass spectrometry, MALDI , TOF, MS.

Books Recommended

- J. L., Jain, Sanjay, and Jain Nitin, (1979) Fundamentals of Biochemistry (6th revised Edition). S. Chand & Co. Ltd. New Delhi.
- Buchanan . B.B. Gruissem, W. and Jones .R.L. (2000) Biochemistry and Molecular Biology of Plants , American Society of Plant Physiologists, Maryland ,USA.
- Albert L. lehninger, Davis L. Nelson, Michael M. Cox. (2004) Lehninger Principles of Biochemistry.
- Lea P.J. and Leegood ,R.C. (1999) Plant Biochemistry and Molecular Biology (2 nd Edition) John Wiley and Sons. Chichester, England
- Berg Jeremy, Tymoczko John, Stryer Lubert (2001) Biochemistry 4th Ed, W. H. Freeman, New York.
- Conn Eric, Stumpf Paul K., Bruuening George, Doi Roy H., (1987) Outlines of Biochemistry 5th Ed , John Wiley and Sons, New Delhi.
- Dawes Edwin A. (1972) Quantitative Problems in Biochemistry, Churchill Livingston, Edinburgh.
- Hall D. D. and Rao K. K. (1996) Photosynthesis 5th Ed., Cambridge University Press. 5. Mandelstam Joel and McQuillen Kenneth (1976) Biochemistry of Bacterial Growth, Blackwell Scientific Publication London.
- Metzler David E. (2001) Biochemistry: The chemical Reactions of Living Cells, Volume 1&2, Academic Press California.
- Moat Albert G. and Foster John W. (1988) Microbial Physiology 2nd Ed. John Wiley and Sons New York.
- Nelson D. L. and Cox M. M. (2005) Lehninger's Principles of Biochemistry, Fourth edition, W. H. Freeman & Co. New York.
- Palmer Trevor (2001) Enzymes: Biochemistry, Biotechnology and Clinical chemistry, Horwood Pub. Co. Chinchester, England.
- Segel Irvin H. (1997) Biochemical Calculations 2nd Ed., John Wiley and Sons, New York.
- Voet Donald and Voet Judith G. (1995) Biochemistry, 2nd Ed.. John Wiley and sons New York.
- White Abraham, Handler Philip, Smith Emil, Hill Rober, Lehman J. (1983) Principles of Biochemistry, Edition 6, Tata Mc-Graw Hill Companies, Inc.
- White David (2000) Physiology and Biochemistry of Prokaryotes. 2nd Ed. Oxford
- University Press, New York.
- Zubay Geoffrey (1998) Biochemistry, 4th Ed., W. C. Brown, New York.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Practical List
M.Sc. I semester
Session 2023-24

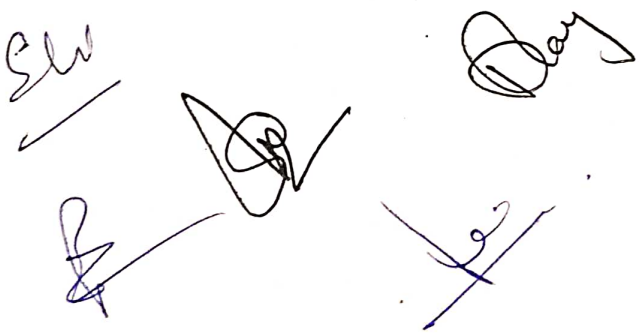
Paper IV: Biomolecules

Suggested list of practicals

1. Preparation of acetate buffer at pH = 5, phosphate buffer at pH = 8, tris buffer at pH = 9.
2. Qualitative assessment of carbohydrate.
3. Qualitative assessment of lipids.
4. Qualitative assessment of proteins.
5. Estimation of protein by Lowry method.
6. Chromatographic separation by paper and thin layer Chromatograph.
7. To prepare standard curve of glucose by anthrone method.

Innovative practical:

8. Isolation of genomic DNA from bacteria
9. Isolation of genomic DNA from fungus



COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Elective Paper

Paper V: Bioenergetics and Intermediary Metabolism

Session 2023-24

M.M:40

Course Outcome

On completion of this course, the learners -

CO 1-Enable to understand finely detailed energy dynamics of a biomembrane, the components involved there in and various physiological attributes driven by aforementioned energy transformation.

CO 2- learn the principle of working of mitochondria as a model of energy transducer

CO 3-learn the anabolic and catabolic processes involving carbohydrates in marinating the energy balance

of the cell.

CO 4- learn the catabolic role of amino acids in the formation of urea and abnormalities due to metabolic errors in these cycles

UNIT I

Bioenergetics: energy transformation, biological oxidations, oxygenases, hydroxylases, dehydrogenases and energy transducing membranes; free energy changes and redox potentials, phosphate potential, ion and proton electrochemical potentials, membrane potentials, chemo-osmotic theory; ion transport across energy transducing membranes, influx and efflux mechanisms, transport and distribution of cations, anions and ionophores. Uniport, antiport and symport mechanisms, shuttle systems.

UNIT- II

The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization; the Q cycle and the stoichiometry of proton extrusion and uptake. Oxidative phosphorylation, uncouplers and inhibitors of energy transfer. Fractionation and reconstitution of respiratory chain complexes. ATP synthetase complex, microsomal electron transport.

UNIT- III

Carbohydrates: glycolysis, citric acid cycle- its function in energy generation and biosynthesis of energy rich bonds, pentose phosphate pathway, alternate pathways of carbohydrate metabolism, gluconeogensis, inter-conversions of sugars, biosynthesis of glycogen, starch and oligosaccharides.

UNIT- IV

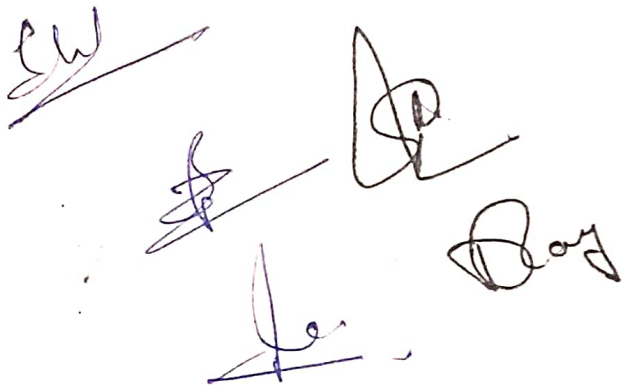
Lipids: fatty acid biosynthesis: acetyl CoA carboxylase, fatty acid synthase; fatty acid oxidation: α, β, oxidation and lipoxidation; lipid biosynthesis: of triacylglycerols, phosphoglycerides and sphingolipids, biosynthetic pathways for terpenes and steroids.

UNIT- V

Amino acids and nucleic acids: biosynthesis and degradation of amino acids and their regulation, specific aspects of amino acid metabolism, urea cycle and its regulation, in-born errors of amino acid metabolism; Nucleic acids: degradation of purines and pyrimidines, regulation of purine and pyrimidine biosynthesis, structure and regulation of ribonucleotide biosynthesis, biosynthesis of ribonucleotides, deoxyribonucleotides and polynucleotides, inhibitors of nucleic acid biosynthesis.

Books recommended

- M.M. Cox and D.L. Nelson (2008) Lehninger Principals of Biochemistry W.H. Freeman & Company
- Otto Hoffmann-Ostenhof (2008) Intermediary metabolism; *Van Nostrand Reinhold (USA)*.
- P.H. Clarke (1978) Intermediary metabolism; *John Wiley & Sons Ltd Hoboken, New Jersey (United States)*.
- Alexander Lowen (1994) Bioenergetics; *Penguin/Arkana Books USA*.
- David G. Nicholls and Stuart Ferguson (2013) Bioenergetics; *Academic Press Elsevier United States*.

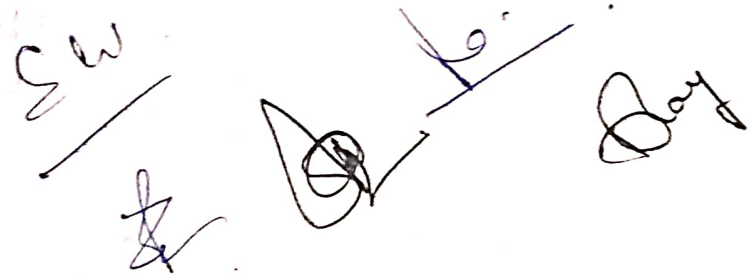


COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Practical List
M.Sc. I semester
Paper V : Bioenergetics and Intermediary Metabolism

Session 2023-24

Suggested list of practicals

1. To prepare acetate buffer of pH4.7.
2. To perform carbohydrate tests of manosaccharides, polysaccharides, disaccharides.
3. To determine protein of unknown sample by Lowry method.
4. To perform the detection of lipid in the given sample



COURSES OF STUDY IN M.Sc. MICROBIOLOGY

SECOND –SEMESTER
Session 2023-24

Paper I: Molecular Biology and Recombinant DNA Technology **M.M:40**

On completion of this course, the learners will -
CO 1 - be able to understand basics of Nucleic acid (DNA and RNA), DNA replication, reverse transcription, transcription, gene expression in prokaryotes and eukaryotes.
CO 2 - gets the Knowledge of global regulatory responses.
CO 3 - be able to understand fundamentals of recombinant DNA technology.
CO 4 – to equip with the knowledge of important molecular techniques

UNIT – I

Nucleic acids as genetic information carriers: DNA structure, melting of DNA; superhelicity in DNA, linking number and topological properties; DNA replication., general principle, various modes of reading, continuous and discontinuous synthesis, asymmetric & dimeric nature of DNA polymerase III & simultaneous synthesis of DNA leading and lagging strands, polymerase and exonuclease activities, eukaryotic DNA polymerases; Mechanism of action of topoisomerases, ligases.

UNIT – II

Initiation of replication and construction of replication fork in test tube; retroviruses and their unique mode of DNA synthesis; relationship between replication and cell cycle in prokaryotes and eukaryotes; inhibitors of DNA replication (blocking precursor synthesis, nucleotide polymerization altering DNA structure).

UNIT III

Transcription: general principles, basic apparatus types of RNA polymerase; steps: initiation, elongation and termination, inhibitors of RNA synthesis, polycistronic and monocistronic RNA's; control of transcription by interaction by interaction between RNA polymerases and promoter regions, role of alternate sigma factors; regulation of rRNA and tRNA synthesis; maturation and splicing of mRNA, cutting and modification of tRNA: catalytic RNA, group I and group II splicing.

UNIT – IV

Gene expression in prokaryotes: induction and repression operon concept, regulatory and structural genes, operator, promoter, repressor and co-repressor, catabolite repression, cyclic AMP, CRP/CAP protein, regulation of lactose, tryptophan, histidine and arabinose operons, attenuation regulation. Gene expression in eukaryotes, Britton and Davidson's model of regulation involvement of HCP, NHCP and hormones. Regulation by N protein and nut sites in DNA binding proteins, enhancer sequences and control of transcription. Global regulatory responses: heat shock response, stringent response and regulation by small molecules such as ppGpp.

UNIT – V

Basic principle of gene cloning, genomic libraries, vectors, strategies of gene cloning using DNA or cDNA inserts, rDNA product: Insulin, gene expression in recombinants, screening method for recombinant clones, important molecular techniques like Southern Blotting, PCR, RAPD, RFLP, DNA sequencing, and probe hybridization.

List of recommended books

1. Molecular cloning: A Laboratory Manual, J. Sambrook; Fritsch and T. Maniatis Cold Spring Harbor Laboratory Press, New York, 2000
2. Introduction to practical molecular biology P.D. Dabre, John Wiley & sons Ltd. New York 1988
3. Molecular Biology LabFax, T.A. Brown (Ed) Bios Scientific Publishers Ltd. Oxford, 1991
4. Molecular Biology of the Gene (4th edition), J.D. Watson N.H. Hopkins, J.W. Roberts J.A. Steitz and A.M. Weiner, The Benjamin/ Cummlngs Publ Co. Inc. California, 1987.
5. Molecular Cell Biology (2nd Edition) J. Darnell, H. Lodish and D. Baltimore, Scientist American Books, Inc., USA, 1994.
6. Molecular Biology of the Cell (2nd Edition) B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, and J. D. Watson, Garland Publishing, Inc., New York, 1994.
7. Gene VI (6th Edition) Benjamin Lewin, Oxford University press, U.K., 1998.
8. Molecular Biology and biotechnology; a comprehensive desk reference, R.A. Meyers (Ed.) VCH Publishers, Inc, New York, 1995
9. Genomes, T.S. Brown.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
SECOND SEMESTER
Practical List
Session 2023-24

Molecular Biology and Recombinant DNA Technology

Suggested list of Practicals

1. Isolation of genomic DNA from fungal samples.
2. Southern blotting
3. To study the effect of UV Radiation on yeast cell.
4. To study the dark repair mechanism in the UV radiated yeast cell.
5. To study the photo repair mechanism in the UV radiated yeast cell.
6. To perform replica plating of yeast cell.
7. To study effect of mutagens EtBr on microbial cells.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Second Semester
Session 2023-24

M.M:40

Paper II: Microbial Genetics

On completion of this course, the learners will
CO 1- be able to identify the molecular basis and types of mutation, their cause and effect.
CO 2- be able to investigate different mechanisms of DNA repair, gene transfer and genetic recombination mechanisms.
CO 3- be able to define types and significance of plasmids in rDNA technology.
CO 4- be able to describe role of microbial genetics in industries, environment and health.

UNIT-I

Gene as unit of mutation and recombination, molecular mechanism of mutation, mutagens, types of DNA damage (deamination, oxdative damage, alkylation, pyridine dimmers). spontaneous mutations-origin, suppression of mutation.

UNIT-II

Gene transfer and genetic mapping, transformations, transfection, conjugation and transduction, genetic mapping of *E,coli*; Molecular aspects of genetic recombination. Innovative topic added – Replica plating

UNIT-III

Complementation analysis, cis-trans test, deletion mapping; Benzer's concept of cistron, overlapping genes. DNA repair- photo repair, excision or dark repair, recombinational repair, SOS repair, methyl- directed mismatch repair, very short patch repair.

UNIT-IV

Plasmids. F-factors description and their uses in genetic analysis; R factors, colocin and col factors; plasmids as vectors for gene cloning; replication of selected plasmids; compatibility. transposons and their uses in genetic analysis, plasmid vectors and bacteriophage vectors.

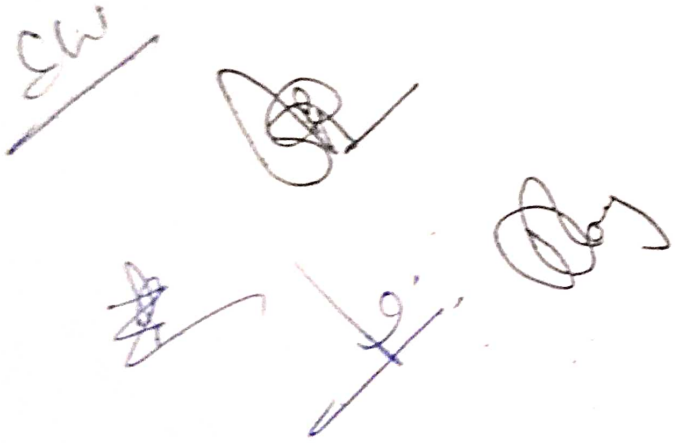
UNIT-V

Important application of advances in microbial genetics, production of proteins, hormones and design of vaccines: conventional as well as new generation recombinant DNA vaccine, their design and advantages.

List of Recommended Books

1. Microbial Genetics by Maloy ET. Al. 1994. Jones and Bartlett Publishers.
2. Molecular Genetics of Bacteria by J. W. Dale. 1994. John Wiley and Sons.
3. Modern Microbial Genetics. 1991 by Streips and Yasbin. Niley Ltd.
4. Gene VII by Lewin Oxford University Press. 2000.
5. Bacterial and Bacteriophage Genetics. 4 th Editions by Birge.
6. Microbial Genetics by Frefielder. 4th Edition.
7. Organization of Prokayotic Genome. 1999 by Robert L.Charlebois, ASM Publications.
8. DNA repair and mutagenesis. 1995 by Errol C. Friedberg, Graham C. Walker and Wolfram, Siede, ASM Publications.

9. Molecular Genetics of Bacteria, 1997 by Larry, Snyder and Wendy, Champness, ASM Publications.
10. Methods of General and Molecular Bacteriology, 1993. Edited by Philip. Gerhardt, ASM Publications.
11. Recombinant DNA by Watson, J.D.
12. Essentials of Molecular Biology by Malacimski.
13. Mobile DNA II by Nancy Craig, Martin Gellet Allan Lambowitz.



Microbial Genetics

Suggested list of Practicals

1. To perform conjugation.
2. To study the effect of UV radiation on Bacterial cells.
3. To study the dark repair mechanism and photo repair mechanism in the UV radiated bacterial cells.
4. To perform replica plating of bacterial cells.
5. To study effect of mutagens (Nitrous acid) on bacterial cells.
6. Isolation of chromosomal DNA
7. Confirmation of nucleic acid by spectral study.

Biostatistics and Computer Application

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Second Semester
Session 2023-24

Paper III: Biostatistics and Computer Application **M.M:40**

On completion of this course -
CO 1-Proficiency of students in various techniques of collection, collation, summarization and presentation of data.
CO2-They could learn basic concepts of probability and probability distribution functions along with
applications.
CO 3-Understanding and applications of descriptive and inferential statistics enabling students to use tests
of significance in biological data.
CO 4-Can apply Analysis of Variance tools and different experimental designs to biological experiments, enabling them to minimize experimental and sampling errors.
CO 5-Understands concepts of correlation and regression tools and techniques, attempts extrapolation and simulation of biological processes.
CO 6-Empowers students to utilize software packages in digital analysis and processing of biological data.
CO 7-Integrate informatics with biology through data submission protocols, sequence alignment and searches, annotations and possible applications in human health and welfare.

UNIT-I
Importance and scope of statistics in biochemical experimentation; Elements of Probability-Mathematical and Statistical definitions; Addition and Multiplication theorems; Probability Distribution Functions – Binomial, Poisson and Normal; Area under normal distribution curve.

UNIT-II
Measures of central tendency: Arithmetic, geometric & harmonic means; Measures of dispersion: range, quartile deviation, variance, standard deviation, coefficient of variation, confidence limits of population mean. Tests of significance hypotheses and errors; student t statistics- population mean equals a specified value; equality of 2 independent means (equal & unequal variance), equality of 2 means (paired samples).

UNIT-III
Analysis of variance: one-way analysis (sample sizes equal and unequal), completely randomized design; two-way analysis (one observation per cell), randomized block design; multiple comparisons: least significant difference, Duncan's new multiple range test.

UNIT-IV
Linear regression: regression diagram and equation, regression coefficient, standard error, significant tests, prediction of dependent variable from the independent variable; linear correlation- scatter diagram, correlation coefficient, standard error, significance tests;

relationship between regression and correlation coefficients; Non parametric tests: Chi-square statistics, test of goodness of fit, test of independence of attributes; standard line interpolation.

UNIT-V

Introduction to Computers: Basic architecture, generations of computer hardware and software; operating systems-WINDOWS and UNIX; system and application software; introduction to internet-LAN, MAN, WAN, Concept of bioinformatics; application of bioinformatics in microbiology.

List of Recommended Books

1. Statistics in biology, Vol. 1 by Bliss, C.I.K. (1967) Mc Graw Hill, NewYork.
2. Practical Statistics for experimental biologist by Wardlaw, A.C. (1985).
3. Programming in C by E. Ballaguruswamy
4. How Computers work - 2000. By Ron White. Tech. Media
5. How the Internet Work 2000 by Preston Gralla Tech. Media.
6. Statistical Methods in Biology - 2000 by Bailey, N.T. J. English Univ. Press.
7. Biostatistics - 7th Edition by Daniel
8. Fundamental of Biostatistics by Khan
9. Biostatistical Methods by Lachin

7. Confirmation of nucleic acid by spectral study.

Biostatistics and Computer Application

Suggested list of Practicals

1. Representation of Statistical data by a) Histograms b) Pie diagrams
2. Determination of Statistical averages/ central tendencies. a) Arithmetic mean b) Median c) Mode
3. Determination of measures of Dispersion a) Mean deviation b) Standard deviation and coefficient of variation c) Quartile deviation
4. Tests of Significance-Application of following a) Chi- Square test b) t- test c) Standard error
5. Computer operations-getting acquainted with different parts of Computers. [DOS] and basics of operating a computer.
6. Creating files, folders and directories.
7. Applications of computers in biology using MS-Office.
   A] MS-Word B] Excel C] Power Point
8. Creating an e-mail account, sending and receiving mails.
9. An introduction to INTERNET, search engines, websites, browsing and Downloading.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Session 2023-24
SECOND – SEMESTER

Elective Paper

Paper IV: Biology of the Immune System **M.M:40**

Course Outcome

Upon successful completion of the course, the student-

CO 1-Will be able to understand the fundamental bases of immune system and immune response.

CO 2-Will be able to gather information about the structure and organization of various components of the immune system.

CO 3-Will be able to understand the genetic organization of the genes meant for expression of immune cell receptors and the bases of the generation of their diversity.

CO 4-Will be able to understand the operation and the mechanisms which underlie the immune response.

CO 5- Will be able to apply the knowledge gained to understand the phenomena like host defense, hypersensitivity (allergy), organ transplantation and certain immunological diseases

UNIT-I

Introduction: phylogeny of immune system, innate and acquired immunity, clonal nature of immune response; organization and structure of lymphoid organs, nature and biology of antigens and super antigens.

UNIT-II

Antibody structure and function; antigen-antibody interactions, major histocompatibility complex, BCR & TCR, generation of diversity, complement system.

UNIT-III

Cells of the immune system; hematopoiesis and differentiation, lymphocyte trafficking. Blymphocytes, T-lymphocytes, macrophages, dendritic cells, natural killer and lymphokine activated killer cells, eosinophils, neutrophils and mast cells. Regulation of immune response: antigen processing and presentation, generation of humoral and cell mediated immune responses, activation of B-and T-lymphocytes, cytokines and their role in immune regulation; T-cell regulation, MHC restriction, immunological tolerance.

UNIT-IV

Cell- mediated cytotoxicity; mechanism of T cell and NK cell mediated lysis; antibody dependent cell mediated cytotoxicity, macrophage mediated cytotoxicity; hypersensitivity autoimmunity, transplantation.

UNIT- V

Immunity to infectious agents (intracellular parasites, helminthes & viruses); tumor immunology; AIDS and other immunodeficiences, hybridoma technology and monoclonal antibodies.

Recommended Books:

1. Kuby immunology, 4th Edition, R.A. Goldsby, Thomas J.Kindt, Barbara, A.Osbarne. (Freedom)
2. Immunology-A short Course, 4th Edition- Ell Benjamin, Richard Coico, GeoffreySunshine (Wiley-Liss).
3. Fundamentals of immunology, William Paul.
4. Immunology, Roitt and others.

Practical List
Session 2023-24
SECOND – SEMESTER

Elective Paper

Paper IV: Biology of the Immune System

Suggested list of practicals

1. To perform test for antibiotics sensitivity by disc method.
2. To determine the minimum inhibitory concentration of given antibiotics.
3. Preparation of blood smear.
4. To isolate serum from blood plasma.
5. To perform agglutination reaction to identification of blood group.

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Session 2023-24
SECOND – SEMESTER

Elective Paper

Paper V: Microbial Metabolism **M.M:40**

Course Outcome

On successfully completing the module -

CO 1-Students will be able to understand the basic knowledge of metabolic pathways, their diversity, specific regulation and their interrelation in different cells.

CO 2-Students will be able to learn about synthesis of certain microbial products of economic importance.

CO 3-Learners will be able to explain the transport of different metabolites generated, with application in industrial processes.

CO 4-Students will be able to gain practical knowledge for analyzing effect of different environmental factors on microbial growth.

UNIT-I

Microbial growth: mathematical expression of growth, growth measurement, efficient growth curve, synchronous growth and continuous culture, effect of environmental factors on microbial growth, nutrients diffusion, active transport, group translocation, solutes, temperature, oxygen relations.

UNIT-II

Chaemolithotrophy: Sulphur, iron, hydrogen, carbon monoxide, nitrogen oxidations. Methanogenesis, luminescence. Brief account of photosynthetic and accessory pigments chlorophyll, bacteriochlorophyll, carotenoids, oxygenic, anoxygenic photosynthesis. Electron transport- photoautotrophic generation of ATP, fixation of CO2- Calvin cycle, reverse TCA, carbohydrate anabolism.

UNIT-III

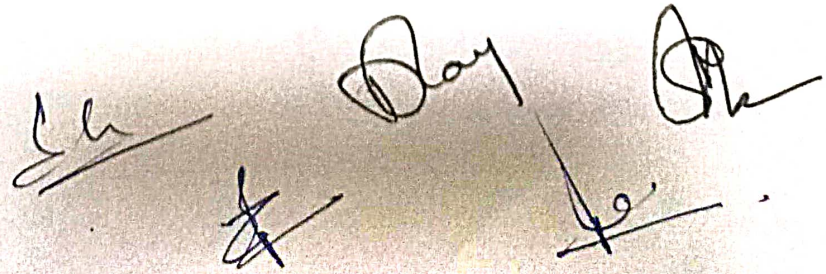
Respiratory metabolism: Embden Mayer Hoff pathway, Entner Doudroff pathway, glyoxalate pathway, Krebs cycle, oxidative and substrate level phosphorylation, Pasteur effect, fermentation of carbohydrates-homo and heterolactic fermentations. Synthesis of polysaccharides-gluconeogenesis and other pathways.

UNIT-IV

Assimilation of nitrogen: Dinitrogen - nitrate nitrogen-ammonia- denitrification, synthesis of major amino-acids, polyamines; peptidoglycan-biopolymers as cell components.

UNIT-V

Microbial development, sporulation and morphogenesis, hyphae vs. yeast forms and their significance. Multicellular organization of selected microbes. Dormancy. Endospore-structure, properties and germination.



List of Recommended Books

1. Doelle H.W. 1969. Bacterial Metabolism. Academic Press.
2. Gottschalk G. 1979. Bacterial Metabolism. Springer Verlag. Moat AG. 1979. Microbial Physiology. John Wiley & Sons.
3. Sokatch JR. 1969. Bacterial Physiology and Metabolism. Academic Press.
4. Moat A G., Foster J W., Spector M P. Microbial Physiology, 4th Ed: Wiley India Pvt Ltd 2009

M.Sc. SECOND SEMESTER
Practical List
Session 2023-24

Microbial Metabolism

Suggested list of Practicals

1. Determination of Bacterial growth by turbidity measurements (spectrophotometric method).
2. Study of effect of temperature on growth of bacteria.
3. Study of effect of pH on growth of Bacteria.
4. Isolation of rhizobia from root nodules.
5. Bacterial growth curve.
6. Isolation of prototrophs
7. Optimization of carbon source for growth of selected microbe
8. Innovative practical - Effect of salinity on growth of bacteria

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

THIRD SEMESTER

Session 2023-24

Paper I: Environmental Microbiology **M.M:40**

Course Outcome

On completion of this course, the learners

CO 1- get acquainted about microbes associated with different natural habitat, microbial interactions, and applications of microbes in pollution control.

CO 2- get equipped with methods of isolating microbes from varied environments, assaying presence of microbes in polluted water, soil and air.

CO 3- get content thus, finds its application in becoming an entrepreneur in eco-friendly products and controlling environmental pollution, the most wanted field of the present scenario at global level.

UNIT-I

Environment: Basic concepts and issues; environmental pollution: types and methods for the measurement; methodology of environmental management-problem solving approach, its limitations; air pollution and its control through biotechnology, air sampling techniques; biodiversity: conservation and management.

UNIT-II

Water pollution and its control: Water as a scarce natural resource, need for water management, sources and measurement of water pollution, waste water treatment-physical, chemical and biological treatment processes; algal blooms and human health.

UNIT-III

Microbiology of waste water treatment: Aerobic process-activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds; anaerobic processes-anaerobic digestion, anaerobic filters, upflow anaerobic sludge blanket reactors; treatment schemes for waste waters of dairy, distillery, tannery industries; biotechnological application of microbes form extreme environment. Low energy waste water treatment

UNIT-IV

UNIT-IV

Microbial degradation of xenobiotics in the environment- ecological considerations, decay behaviour & degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides; bioaccumulation of metals and radio-nucleids and detoxification; bioremediation.

UNIT-V

Biological N_2 fixation, H_2 production, biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production). Single cell protein (*Spirulina*, yeast, mushroom); global environmental problems-ozone depletion, UV-B green house effect and acid rain, their impact and biotechnology approaches for management.

List of Recommended Books

1. Wastewater Engineering- Treatment, disposal and Reuse. Metcalf and Eddy, Inc,.Tata McGraw Hill, New Delhi.
2. Comprehensive Biotechnology. Vol. 4, M. Moo-young (Ed-in-chief), Pergamon Press, Oxford.
3. Environmental Chemistry, A.K. De. Wiley Eastern Ltd. New Delhi.
4. Introduction to Biodeterioration. D. Allsopp and K.J. Seal, ELBS/Edward Arnold

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Third Semester Practical
Session 2023-24

Environmental Microbiology

Suggested list of Practical

1. Survey of degradative of aromatic hydrocarbons by bacteria.
2. To study the impact of heavy metals on growth & survival of microbes.
3. To study the impact of pesticides on the growth and survival of microbes.
4. To study the impact of salt and osmotic stress on the growth survival of microbes.
5. Detection of coliform for determination of the purity of potable water
6. Determination of the efficiency of removal of air pollutant by using Air sampler

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Paper II: Medical Microbiology
Session 2023-24

M.M:40

Course Outcome:

On completion of this course, the learners

CO 1- are imparted with the concepts in medical microbiology including: pathogenic microorganisms and the mechanisms by which they cause disease in the human body, Preventive measures for diseases, factors that limit microbial growth and survival in diseases, diagnostics strategies,

CO 2- can define role of the human body's normal microflora and key concepts in immunology and immunization.

CO 3- will be enriched to serve the society with intense knowledge of disease causing microbes.

UNIT-I

Early discovery of pathogenic microorganisms; development of bacteriology as scientific disciplines; contribution made by eminent scientists. Normal microbial flora and the human host; role of resident flora; classification of medically important microorganisms, dermatophytes, dimorphic fungi, opportunistic fungal pathogens, laboratory diagnosis of pathogenic fungi.

UNIT-II

Mechanism of pathogenicity, virulence and protection, organs and cells involved in immune system and immune response; antigens, antigenic specificity, antigenic determinants, cellular and humoral basis of immunity: immunoglobulins, antigen and antibody reactions, immunological (serological as well as cellular) methods.

UNIT-III

Classification of pathogenic bacteria- *Staphylococcus, Streptococcus, Pneumococcus, Corynebacteria, Bacillus, Clostridium,* non-sporing anaerobes, organisms belonging to *Enterobacteriaceae. Vibrios*, non- fermenting bacilli, *Yersinia, Haemophilus, Bordetella, Brucella, Mycobacteria, Spirochaetes,* Actinomycetes, *Ricketisae, Chlamydiae.*

UNIT-IV

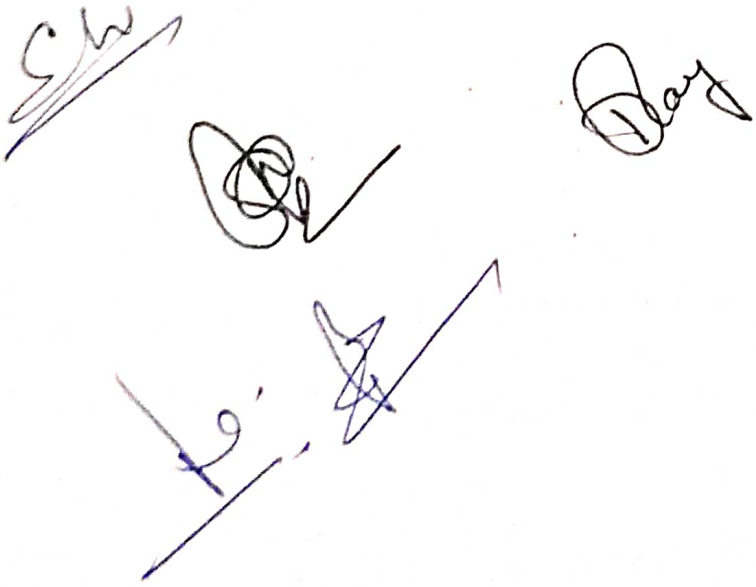
Important RNA and DNA viral pathogens; virus host interactions; pox viruses, adenoviruses, picornaviruses, orthomyxoviruses, paramyxoviruses, arboviruses, rhabdoviruses; general properties of pathogenic protozoans and diseases caused by them, slow virus disease.

UNIT-V

Laboratory control of antimicrobial therapy; strategies/ approaches (conventional and modern) in the diagnosis of important disease/ syndrome; meningitis, urinary tract infection, sexually transmitted diseases, pyrexia of unknown origin, wound infection etc.

List of Recommended Books

1. Mims CA (2004). Medical Microbiology, 3rd ed, Mosby
2. Carter JB & Saunders VA (2007) Virology-Principles and Applications, John Wiley and Sons
3. Paniker CKJ (2007). Ananthanarayan and Paniker's Textbook of Microbiology, Orient Longman Pvt. Limited, India.
4. Greenwood D, Slack RCB & Peutherer JF (2006). Medical Microbiology, A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis & Control, Churchill Livingstone, Elsevier, India.
5. Baron EJ, Peterson LR & Finegold SM Mosby (1990). Bailey and Scott's Diagnostic Microbiology
6. Brooks GF, Butel JS, Morse SA, Melnick JL, Jawetz E & Adelberg EA (2004). Jawetz M & Adelberg's Medical Microbiology, 23rd ed, Lange Publication.
7. Mackie & McCartney Practical Medical Microbiology (1996). Collee JG, Fraser AG, Marmion BP & Simmons A (eds.), Churchill Livingstone,Edinburgh



Determination of the efficiency of removal of air pollutant by using Air sampler

Medical Microbiology

Suggested list of practicals

1. Detection of susceptibility to dental caries.
2. Bacteriological examination of skin and throat.
3. Isolation of enteric pathogens by direct plating method.
4. General tests for identification of bacteria from clinical samples including IMViC test, Carbohydrate fermentation test, Nitrate reduction test, Triple sugar agar test, Urease test, Catalase test, Oxidase test.
5. Study of dimorphic fungi.
6. Study of agglutination reaction by blood grouping.
7. ELISA (to demonstrate immunological reaction by ELISA technique).
8. Double diffusion technique (study of precipitation reation by Ouchterlony Double Diffusion).

Innovative practical –

9. Motility testing of bacterial isolates
10. KOH mount preparation

COURSES OF STUDY IN M.Sc. MICROBIOLOGY

Paper III: Agricultural Microbiology
Session 2023-24

M.M:40

Course Outcome:

On completion of this course, the learners

CO 1- learns plant microbe interactions for the applications in biofertilizer production and gene protection etc.

CO 2- will also familiarize with the concept of microbes involved in diseases of economically significant crops, integrated pest management and disease control measures,

CO 3- attains knowledge of techniques to access and improve soil quality for increased crop production.

UNIT – I

History, scope and development of agricultural microbiology, rhizosphere and phyllosphere: concept, importance, factors affecting microbial diversity.

UNIT – II

Soil health: crop residues, humus, mineralization, immobilization, soil-sickness, composting, vermicomposting, green manure. Effect of crop residues on plant growth; biodegradation of pesticides and pollutants; biodegradation fate, bioavailability, acceleration, bioremediation. Biofertilizers: types, production, formulation and constraints.

UNIT – III

General idea about major agricultural pests: Plant diseases- late blight potato. downy mildew of pea, stem gall of coriander, powdery mildew / rust / smut, rust of linseed, Ergot of bajara, Anthracnose of soybean, Tikka disease of groundnut, wilt of arhar, bacterial blight of paddy, citrus canker, leaf curl of papaya, little left of brinjal. Insects: gram, soybean. Weeds: parthenium, xanthium, waterhyacinth, cyperus, phalaris

UNIT – IV

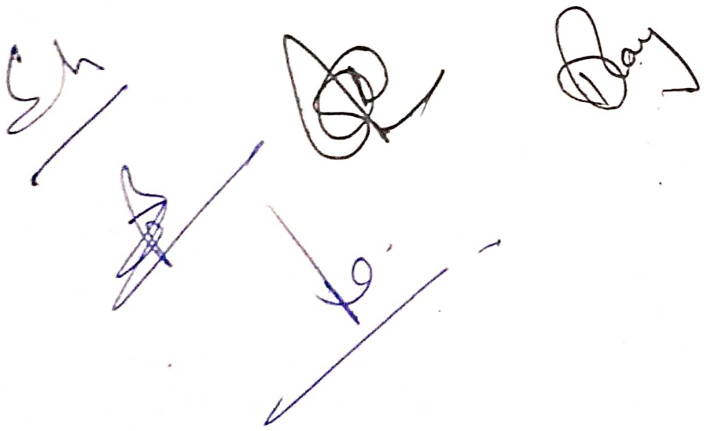
Post harvest losses of agricultural products: causes, problems and management recent trends in pest management: strategies, mass production, formulation and application technology, achievements, constraints

UNIT – V

Biotechnology in agriculture: the new green revolution, transgenic crops, gene protection technology, frost control technology, resistant varieties. Bioconversion futurology: exploitation of agricultural wastes for food / feed and fuel.

List of Recommended Books

1. Soil microbiology by Subba Rao
2. Soil and microbes by Waksman and Starkey.
3. Plant pathology by Mehrotra.
4. Alexander, M. Introduction to Soil Microbiology, 3rd Edition. Wiley Eastern Ltd., New Delhi
5. Microbiology by S.S. Purohit.



COURSES OF STUDY IN M.Sc. MICROBIOLOGY
Third Semester Practical
Session 2023-24

Agricultural Microbiology

Suggested list of Practicals

1. Isolation and Enumeration of the bacteria from soil by serial dilution agar plate method.
2. Isolation of fungi from soil by warcup's method.
3. Isolation of Azotobacter species from soil by pour plate method.
4. Isolation and comparison of microorganism from rhizospheric and non rhizospheric soil.
5. Isolation of microorganisms from phyllosphere by leaf impression method.
6. Study of Plant diseases – leaf curl of papaya, rust of wheat, citrus canker, red rot of sugarcane.
7. Study of weeds- Parthenium and water hyacinth.

Innovative practical:

8. Microbes and solid waste management
9. Study of millets: Microflora, varieties grown in Jabalpur region, storage conditions. nutrient content in Pearl Millet.
10. Study of local weeds of Jabalpur

COURSES OF STUDY IN M.Sc. MICROBIOLOGY
THIRD SEMESTER

Elective Paper

Paper IV: Bioprocess Engineering and Technology
Session 2023-24

M.M:40

Course Outcome:

On completion of this course, the learners -

CO 1- acquires theoretical and experimental knowledge of strain improvement of microbes for mass production of microbial products like ethanol, antibiotics vitamins, enzymes etc.

CO 2- will acquire the skill entangled in microbial examination of dairy products as well as production of fermented food and microbial protein.

UNIT-I

Biofermentation: designing and application, principles of biofermentation, monitoring and control of parameters (pH, oxygen, agitation, temperature, foam etc.), batch & continuous; production medium, raw materials, isolations; maintenance, preservation & improvement of industrial strains, computer control of fermentation processes.

UNIT-II

Downstream processing: Filtration of fermentation broths, ultra-centrifugation, recovery of biological products by distillation, superficial fluid extraction

UNIT-III

Industrial production of solvents: Ethyl alcohol, citric and acetic acids; enzymes; amylases, proteases, cellulases; vitamins: vitamin B12, vitamin C, antibiotics (penicillin, streptomycin, tetracycline and griseofulvin). Microbes in petroleum industry (oil recovery); immobilized cells & enzymes.

UNIT-IV

Microbiology of food: sources and types of microorganisms in food, food borne pathogens, microbiological examination of food, spoilage of food, food preservation, fermented foods, microbial proteins.

UNIT-V

Dairy microbiology: sources and types of microorganisms in milk, microbial examination of milk, pasteurization and phosphatase test, sterilization of milk, grades of milk, dairy products, fermented milk, butter & cheese.

Recommended Books:

1. Biochemical Engineering, Aiba, S., Humphrey, A.E. and Millis, N.F. Univ of Tokyo Press, Tokyo.

2. Biochemical Reactors, Atkinson, B: Pion Ltd. London.

3. Biochemical Engineering Fundamentals, Baily, J.E. and Ollis, D.F. McGraw-Hill Book Co. New York.

4. Bioprocess Technology: Fundamental and Application, KTH, Stockholm.

5. Process Engineering in Biotechnology, Jackson, A.T., Prentice Hall, Engelwood Cliffs.

6. Bioprocess Engineering: Basic Concepts, Shuler, M.L. and Kargi, F., Prentice Hall, Engelwood Cliffs.

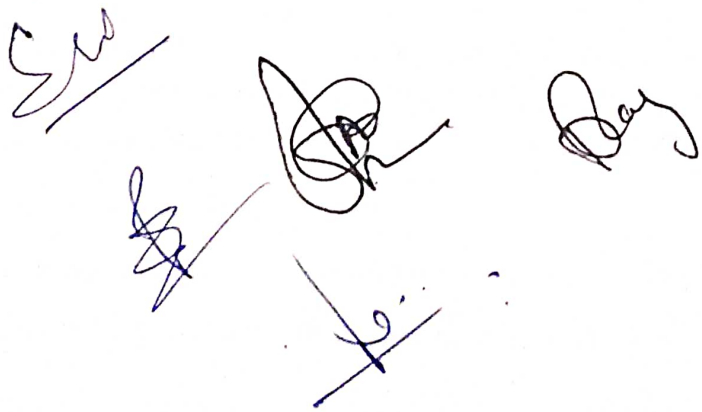
7. Principles of Fermentation Technology, Stanbury, P.F. and Whitaker, A. Pergamon Press, Oxford.

8. Bioreaction Engineering principles, Nielson, J. and Billadsen, J. Plenum Press.

9. Chemical Engineering Problems is Biotechnology, Shuler, M.L. (Ed.) AICHE.

10. Biochemical Engineering, Lee, J.M. Prentice Hall Inc.

11. Bioprocess Engineering-kinetics, Mass Transport, Reactors and Gene Expression, Viet; W.F., John Wiley & Sons, Inc.



M.SC. THIRD SEMESTER

PRACTICAL LIST

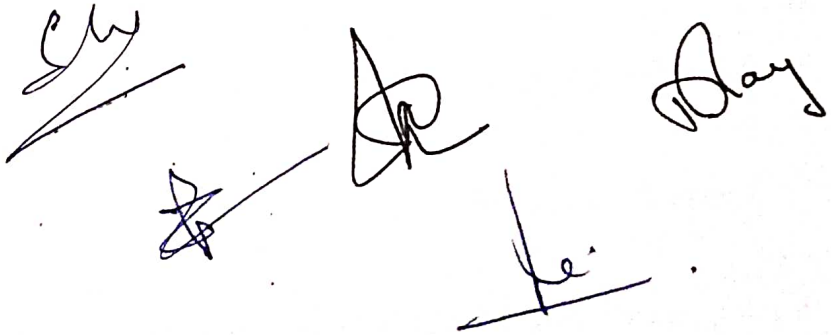
Session 2023-24
Bioprocess Engineering and Technology

Suggested list of Practicals

1. Isolation of micro-organism from canned food.
2. Isolation of bacteria and fungi from spoiled food
3. Quantitative test of milk by resazurin test.
4. Isolation of amylase producing bacteria from soil.
5. Microbial analysis of dairy products

Innovative Practicals

6. Isolation of microorganism from dairy products
7. Isolation of *Trichoderma* from soil



COURSES OF STUDY IN M.Sc. MICROBIOLOGY
THIRD SEMESTER

Elective Paper

Session 2023-24

Paper V: BIOTECHNOLOGY **M.M:40**

Course Outcome

Upon successful completion of the course, the student -

CO 1-Will learn about various industrially relevant microbial products and their production process, role

of biotechnology in environment management.

CO 2-Acquires knowledge about strains development, selection of hyper producers, microbial products, metabolic engineering and various industrial relevant microbial products and their production process

CO 3-Learns about sterilization at reactor scale and different types of sterilization strategies

CO 4-Attains knowledge about designing large scale industrial processes and types of cultivation strategies Understands the concept of recombinant biomolecules, therapeutic proteins, vaccines, antibodies, bio-pesticides, bio-fertilizers, and probiotics .

CO 5- Understands different types of regulatory approvals required for drug development

UNIT I

Biotechnology an Overview, Definition, Perspective and scope of biotechnological processes and products, Biotechnology and Ethics, Introduction, Medical and chemical Biotechnology, Agriculture and Food, Energy and environment and human, Bioethics, Facing problem and finding solutions, Regulating the use of biotechnology, Patenting biotechnology inventions.

UNIT II

Genetic Engineering and gene cloning, Introduction of genetic engineering procedure, restriction endonuclease, cloning vehicle, Vectors for animals and plants, Insertion of DNA molecule in to a vector, Direct transformation, Isolation and cloning, Transformation and growth of cells, Selection and screening of particular recombinants, Genomic library, sequencing of DNA, Gene identification and mapping, Analysis of expression of cloned genes, Polymerase chain reaction, Monoclonal Antibodies.

UNIT III

Plant cell and tissue cultures, Culture techniques, Protoplast fusion, Direct gene transfer, Microinjections, Nuclear transplantation, Plastid and mitochondrial genes, production of secondary metabolites by immobilized plant cell, Development of disease resistant, herbicide resistant, Salt & drought resistant plant varieties, Microbial Toxins, Introduction, Toxins gene isolation, Genetic engineering of *B. thuringiensis* strains, *Baculovirus* as biocontrol agents.

UNIT IV

Culturing microorganisms for the production of biomass, Production of microbial (Bacterial, Cyanobacterial and Fungal) products, Batch culture, Continuous culture, Fed-batch culture, Mass culture, Use of culture system for the production of microbial products, Production of cyanobacterial biomass for food, Feed and health care products, Improvement of microbial strains for industry, Agriculture, Immobilization of microbial cells and enzyme and its applications.

UNIT V

Strain improvement, bioreactor design, Reactor types, Application of immobilized cells and enzyme, improvement in bioreactor to control environment of process organism. use of microorganisms in pollution control, Waste treatment, Bioremediation, Biological removal of eutrophic nutrients, Heavy metals, Toxic chemicals (Herbicide, Insecticide and Fungicide and Other Toxicants) from waste water and industrial effluents, Utilization of waste water for the production of food and feed, Biodegradation, Bioleaching of metals, Application of microorganisms from environment

Books recommended

- Haekett P. B., Fuchs J. A. and Mesing J. W. (1988) An Introduction to Recombinant DNA techniques – basic experiments in gene manipulation.
- Glck B. R. and Thompson J. E. (1993) Methods in Plant Molecular Biology and Biotechnology.
- Bjorn Kristiansen, (2012) Basic Biotechnology third Edition.

M.SC. THIRD SEMESTER

PRACTICAL LIST

BIOTECHNOLOGY

Session 2023-24

Suggested list of practicals

1. Demonstration:-
   - PCR
   - Spectrophotometer
   - pH meter
   - Centrifuge
   - Photomicrographic Camera
2. To prepare the media for plant tissue culture.
3. Isolation of pathogenic fungi from infected plants/Disease plants (Leaf/ Stem/ root)
4. Identification of unknown microorganism from given plates.
5. Preparation of tissue culture media.