



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Science
Name of Program: B.Sc. (Major: Chemistry)
(2022-2025)

Semester IV

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCCH401	UG	Applied Chemistry	60	20	20	30	20	4	0	4	6

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit.
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes.

1. Enable the students to apply basic concepts, and applications of Heavy inorganic chemicals.
2. To study the preparation and applications of different types of catalysts and solvents.
3. To provide the theoretical understanding of applied industrial techniques as Biotransformation, MAOS and their practical applications.
4. The purpose of the course is to make the students to understand the determination of cations, anions, analysis of Water quality as DO, BOD, COD, and analysis of Oils, Fats, Paint.

Course Outcomes (COs):

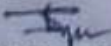
After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:


1. Theoretical understanding of microwave induced reactions, sonochemistry and applications
2. The preparation and industrial application of different catalysts and solvents.
3. The industrial manufacturing process, and applications of economically important heavy inorganic chemicals.
4. Sampling and analytical procedure of water and wastewater, oils, fats, paints.

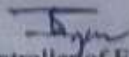
Syllabus

Unit I: Heavy Inorganic Chemicals

Basic concept of heavy inorganic chemicals and manufacture of following with reference to:


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(i) Raw material, (ii) Production process, (iii) Quality control, (iv) Hazards and safety, of the following chemicals - Ammonium phosphates, super phosphate, triple super phosphate, carbon blacks, manufacture of graphite and carbon, calcium carbide, silicon carbide, sodium thiosulphate, borax, and boric acid.

Unit II: Catalysts and Solvents


Introduction, preparation, synthetic application of the following catalysts - Raney Nickel, Palladium, Copper chromate, Vanadium, and Platinum-based catalyst. Aluminium alkoxides, and Titanium tetrachloride. Industrial solvents (specialty): Synthesis, properties, and uses of Dimethyl formamide (DMF), Dimethyl sulfoxide (DMSO), Tetrahydrofuran (THF), Green solvents and its applications (Ethanol, MeOH, Isopropyl acetate)


Unit III Analysis of Oils, Fats, and Paint:

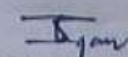
Introduction, classification of oils and fats, physical and chemical properties of oils and fats. Determination of viscosity, density, thermal properties, and flash point, saponification number, iodine number and acid number. Introduction to paints, definition, varnishes, enamels, lacquers and thinners, formulation and manufacturing of paints, different types of paints, surface coatings, analysis of paints and varnishes, applications of paints.

Unit IV Assessment of Water Quality:

Sources of water, sampling procedure of water and wastewater, classification of water for different uses, types of water pollutants and water quality standards for drinking water. Analytical methods for the determination of the following ions in water: Anions: CO_3^{2-} , HCO_3^- , F^- , Cl^- , SO_4^{2-} , PO_4^{3-} , NO_3^- , NO_2^- ; Cations: Fe^{2+} , Fe^{3+} , Ca^{2+} , Mg^{2+} , Cr^{3+} . Determination of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).


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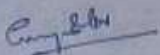
Unit V: Applied industrial techniques:


Introduction of Bio-transformations, types and examples, enzyme catalyzed reactions, different types, examples, mechanism of Bio-transformations with examples, industrial applications of Biotransformation, advantages, and limitations. Microwave induced reactions- theory, principle, advantages, mechanism, examples. MAOS-Industrial applications. Sonochemistry - theory, examples, industrial applications.

List of Practical: Practical: (Credits: 2, Laboratory periods: 04)

1. Analysis of commercial fertilizer sample (DAP, Super phosphate)
2. Investigation of selected physical and chemical properties of Borax
3. Synthesis of Azo dye and Colorimetric estimation of Azo dye
4. Estimation of Amino acids (standard sample and Unknown food sample)
5. Microwave Assisted Organic Synthesis (MAOS) preparation of Inorganic compound
6. Microwave Assisted Organic Synthesis (MAOS) preparation of Organic compound
7. Estimation of heavy metal ions in the water sample by Titrimetric method


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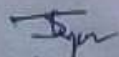
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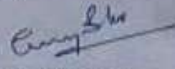
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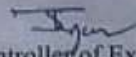
8. Experiment on the principles and applications of TLC and Paper Chromatography
9. Study of principles and applications of Column Chromatography (with experiment)
10. Study the Bio-transformation reaction of Yeast – Hydrolysis of Acetanilide

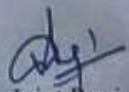
References

1. Admson, A.W., Physical Chemistry of Surfaces, 4th edition, Pubs: John Wiley & Sons, New York.
2. Austin H. T., Shreve's Chemical Process Industries, Pubs: McGraw Hill Book Company, New York
3. Rao, C. N. R, Muller, A and Cheetam, A.K. (Eds) : The Chemistry of Nanomaterials, Vol.1, and 2, Wiley-VCH, Weinheim.
4. Poole, C. P and Owens: F. J : Introduction to Nanotechnology Wiley Interscience, New Jersey
5. Shreve R. N., Chemical process industries, 5th Edition, McGraw Hill Book Company, New York.
6. Sharma, B.K., Industrial chemistry 7th Edition, Krishan Prakashan, 2014
7. Rells, K.M., Courtney, T., and Wulff, J., Introduction to material science and engineering, 9th Edition, Wiley Eastern Pvt. Ltd., New Delhi, 2016.
8. Arun Sethi., Systematic Lab experiments in Chemistry, New Age International (P) Limited, Publishers, New Delhi, 2003.


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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science Department of Life Science B.Sc. (Major - Biotechnology)

SEMESTER IV

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BSCBT401	Major	Genetics and Molecular Biology	60	20	20	30	20	4	-	4	6

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Course Objectives:

1. Knowledge of basics in genetics and classical genetics covering prokaryotic / phage genetics to yeast and higher eukaryotic domains.
2. Concepts of Mendelian genetics, population genetics, quantitative genetics encompassing complex traits, clinical genetics and genetics of evolution.
3. Study of Genome Organization and its dynamics
4. Study of DNA replication, damage and repair
5. Study of transcription and translation


Course Outcomes:


1. Understanding of fundamental molecular principles of genetics and the relationship between phenotype and genotype.
2. Understanding the basics of genetic mapping and regulation of gene expression.
3. Understanding the basic genetic mechanisms at the molecular level
4. Understanding the molecular mechanism of mutation
5. Understanding the process of transcription and translation

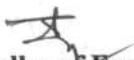
Unit – I

A. Genetics

Mendelian Laws of genetics, Dominance, Segregation, Independent Assortment; Epistasis, Complementary ratio and supplementary ratio, Cytoplasmic inheritance; plastid and kappa particles.


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**Shri Vaishnav Institute of Science
Department of Life Science
B.Sc. (Major - Biotechnology)**

BSCBT401 Genetics and Molecular Biology

Linkage and crossing over (Coupling and repulsion hypothesis) Mechanism of crossing over and its significance.

Mechanism of sex determination (Chromosomal theory), sex linked inheritance.

Unit-II

Chromosome morphology, classification, karyotyping; Specialized chromosomes-Polytene and Lamp brush chromosome,

Structural and numerical chromosomal aberrations.

Chromosome related disorders: Klinefelter's syndrome, Turner's syndrome, Down's syndrome and Cri-du-chat syndrome

Mutations- Spontaneous and induced, Chemical and physical mutagens, Molecular basis of mutation.

Unit-III

B. Molecular Biology

Transformation, Conjugation and transduction in bacteria; Gene mapping in bacteria;

Prokaryotic and eukaryotic DNA replication and Transcription, Processing of m-RNA, Splicing, DNA and RNA polymerases

Unit-IV

Prokaryotic and Eukaryotic Translation - Mechanism of initiation, elongation and termination.

Gene regulation in Eukaryotic system – Promoters, enhancers elements and gene amplification.

Unit –V


Genetic Code and Translation


Correspondence of amino acid sequence in proteins; Properties of genetic code- universal code, degeneracy and redundancy, Wobble hypothesis;

Co- and post-translational modifications- Antisense RNA.

PRACTICAL II [Genetics + Molecular Biology]

1. Solving problems on monohybrid and dihybrid ratios, multiple alleles, epistasis.
2. Solving problems on quantitative inheritance.
3. Inheritance patterns in human – Pedigree analysis.
4. Solving problems on localization of genes


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**Shri Vaishnav Institute of Science
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BSCBT401 Genetics and Molecular Biology

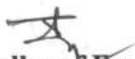
5. Isolation of plasmid DNA.
6. Isolation of DNA from plant cells.
7. Isolation of DNA from human whole blood.
8. Determination of purity and concentration of DNA - Spectrophotometric method.

BOOKS:

1. Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2006). Principles of Genetics. (8th Ed.). John Wiley & Sons.
2. Griffiths, A. J.F., Doebley, J., Peichel, C., & Wassarman, D. A. (2020). An introduction to Genetic Analysis. (12th Ed.). W.H. Freeman publication.
3. Hartl, D. L., & Jones, E. W. (1998). Genetics: Principles and Analysis. (4th Ed.). Sudbury, MA: Jones and Bartlett.
4. Alberts, B., Johnson, A. D., Lewis, J., Morgan D., Raff, M., Roberts, K., & Walter, P. (2015). Molecular Biology of the Cell. (6th Ed.). New York: Garland Science.
5. Brown, T. A. (2017). Genomes 4. (4th Ed.). Wiley Publishers (Asia Pvt Ltd).
6. Freifelder, D. (2012). Molecular Biology. (5th Ed.). Narosa Publishing House, India.
7. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2017). Lewin's Genes XII. (12th Ed.). Jones and Barlett Inc. USA.


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NATIONAL EDUCATION POLICY

DEGREE PROGRAM

B.Sc. Phys. IV Sem

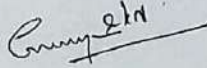
Major/ Minor

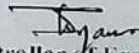
Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BSCP11401	DC	Optics & Laser	60	20	20	00	00	4	0	0	4

Course Objectives	<ol style="list-style-type: none">1. To understand the concept of Waves, their types and propagation in different medium.2. To understand and apply the concepts of phenomenon of interference, diffraction and polarization.3. To Learn and comprehend the Concepts of LASER.4. To be able to solve Numerical problems based on the course.5. To develop the ability to complete the tasks in time.
Course Outcomes	<ol style="list-style-type: none">1. Students will be able to understand the Waves, their types and propagation in different medium.2. Students will be able to understand and apply the Concepts of Interference, Diffraction and Optical Polarization.3. Students will be able to Learn and comprehend the Concepts of LASER.4. Students will be able to solve Numerical problems based on the course.5. Students will be able to complete the tasks in time.

Abbreviation		Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).
Th	Theory	
T	Tutorial	
P	Practical	Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).


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BSCPH401	DC	Optics & Laser	60	20	20	00	00	4	0	0	4

UNIT I: Interference of light

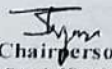
Condition of constructive and destructive interference, necessary condition of interference. Interference of light by division of wave front: Fresnel's Bi-Prism, shape of biprism fringes. Interference by division of amplitude, interference in thin films, path difference, phase difference due to reflection from denser medium: Stokes law, localized fringes, Wedge shape films, Newton's rings and applications. Michelson interferometer and its application.

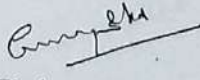
UNIT II: Diffraction

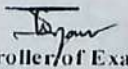
Fraunhofer's diffraction at a single slit, double slit, plane transmission grating, n-slit diffraction, formation of spectra by the grating, determination of wavelength of light by with a grating, resolving power of an optical instruments, Rayleigh criterion of resolution of images. Resolving power of plane transmission grating.


UNIT III: Polarization

Polarization of light, production of plane polarized light by reflection: Brewster law, Production of plane polarized light by double refraction: double refraction in uniaxial crystal, Huygens explanation of double refraction, calcite crystal, Nicol prism, quarter and half wave plates, circularly and elliptically polarized light, analysis of polarized light, rotation of plane of polarization, polarimeter, Laurent's half shade device.


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BSCPH401	DC	Optics & Laser	60	20	20	00	00	4	0	0	4

UNIT IV

Spontaneous and Stimulated Emission. Einstein Coefficients, Population Inversion, Pumping, Resonator, Properties of Laser: Intensity, Brightness, Monochromaticity, Coherence (Temporal and Spatial), Directionality, Ultra short duration Pulses, Polarizability. Applications of Laser based on above properties.

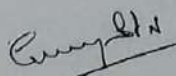
UNIT V:

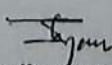
Classification of Lasers, 2, 3 and 4- Level Pumping Scheme, Pumping Techniques: Optical Pumping, Electrical Discharge Pumping, Chemical Pumping, Gas Dynamic Pumping, Injection Pumping. Various Laser Systems: Ruby Laser, He-Ne Laser, Co₂ Laser, Nd: YAG Laser Diode laser.

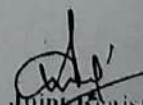
References

1. Fundamentals of Optics: F.A. Jenkins and H. E. White, 1976, McGraw-Hill.
2. Principles of Optics: B. K. Mathur, 1995, Gopal Printing. . University Physics: F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986.
3. Optics: A. K. Ghatak, McGraw Hill Publications. . Principles of Optics: Max Born and Wolf. Pregmon Press. . Optics and Atomic Physics, D. P. Khandelwal. Himalaya Publication.
4. Lasers: Theory and Applications: K. Thyagrajan and A. K. Ghatak.


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BSCPH401 (P)	DC	Physics Laboratory IV	-	-	-	30	20	0	0	4	2

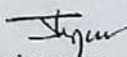
Course Objectives

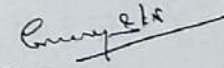
1. To learn how to operate the optical instruments and take the observations.
2. To apply and experimentally verify the laws of Optics.
3. To present the data graphically and its analysis.
4. To learn the optimal usage of resources.
5. To work ethically as member as well as leader of a diverse team.

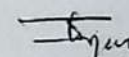
Course Outcomes

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3. Student will be able to present the data graphically and analyse it.
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 Vishwavidyalaya, Indore


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NATIONAL EDUCATION POLICY

DEGREE PROGRAM

B.Sc. Phys. IV Sem

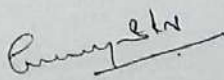
Major/ Minor

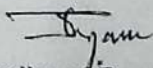
Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*				
BSCPH401 (P)	DC	Physics Laboratory IV	-	-	-	30	20	0	0	4	2

List of experiment

1. To determine the refractive index of the material of the prism using Na light.
2. To determine the dispersive power of the material of the prism.
3. Measurement of radius of curvature R of convex lens by Newton's ring experiment.
4. Measurement of resolving power of telescope.
5. Measurement of wavelength of Na light source using diffraction grating.
6. To determine the mass of cane sugar dissolved in water using half shade polarimeter.
7. Measurement of wavelength of Diode Laser using diffraction grating.
8. Measurement of resolving power of prism.
9. Measurement of resolving power of grating.
10. Determination of Numerical Aperture and Acceptance Angle of optical fiber


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Name of the Program: B. Sc. (Mathematics)

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 401	DC	Differential Equations II	60	20	20	-	-	3	0	-	3

Course Objective

To introduce the students to the fundamentals of the Differential Equation.

Course Outcomes

After the successful completion of this course students will be able to:

1. Learn various techniques of getting series solution of a differential equation.
2. Understand the concept of partial differential equation.
3. Apply various techniques of partial differential equation.
4. Use the concept of partial differential equations to real world problems.

Course Content:

UNIT – I

Series Solution of differential equations, Power Series Method, Series solution of Bessels and Legendre equations (without properties).

UNIT – II

Formation of partial differential equation, Linear Partial differential equation of First order (Lagrange's linear equation).

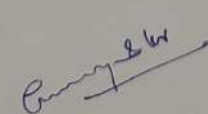
UNIT – III

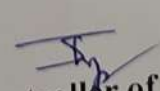
Non-linear Partial differential equation of First order (Standard forms and Charpit's Method), Solution of Homogeneous and Non-homogeneous linear PDE with constant coefficients.

UNIT – IV

Partial differential equations reducible to equations with constant coefficients. Solution of PDE by method of separation of variable.


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			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 401	DC	Differential Equation II	60	20	20	-	-	3	0	-	3


UNIT – V


Applications to the solution of One-Dimensional Heat and Wave equations, Solution Laplace equation. Classification of second order partial differential equations.

Reference Book:

1. Differential Equations – Lester R. Ford (McGraw Hill).
2. Differential Equations – S. L. Ross (John Wiley).
3. Differential Equations – H. T. H. Piaggio.
4. A Text Book of Ordinary Differential Equations – Kiseleyev, Makarenko & Krasnov (Mir).
5. Differential Equations – H. B. Phillips (John Wiley & Sons).
6. Differential Equations with Application & Programs – S. Balachanda Rao, H.
7. Text Book of Ordinary Differential Equations (2nd Ed.) – S. G. Deo, V. Lakshmikantham & V. Raghavendra (Tata McGraw Hill).
8. An Elementary Course in Partial Differential Equation – T. Amarnath (Narosa).
9. Differential Equations: Ray Singhania, S. Chand & Com.


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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSCMT 402	DC	Numerical Methods	60	20	20	-	-	3	0	-	3

Course Objective

To introduce the students with the fundamentals of the Numerical Methods.

Course Outcomes

After the successful completion of this course students will be able to:

- 1. Apply various numerical methods to obtain numerical solution of definite integration and algebraic and transcendental equations.*
- 2. Learn various techniques of getting solutions of linear system of equation.*
- 3. Use various techniques of interpolation methods.*
- 4. Learn various techniques of numerical differentiation and numerical Integration.*
- 5. Find numerical solution of ordinary differential equation.*

Course Content:

UNIT – I

Numerical errors, Numerical methods for solving nonlinear equations: Method of bisection, Secant method, False position method, Newton-Raphson method, Fixed point method.

UNIT – II

Linear Equations: Direct Methods for Solving Systems of Linear Equations (Gauss-Jordan Elimination, LU Decomposition), Iterative Methods (Jacobi, Gauss-Seidel Reduction Methods).

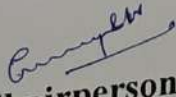
UNIT – III

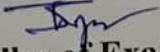
Introduction to Interpolation, Calculus of finite differences, Difference Operators, Relation between Operators, Interpolation with equal interval: Newton's Forward and Backward Interpolation formula.

UNIT – IV

Interpolation with unequal interval: Newton divided difference interpolation formula and Lagrange's interpolation Formula, Lagrange's Inverse interpolation Formula.


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BSCMT 402	DC	Numerical Methods	60	20	20	-	-	3	0	-	3

UNIT – V

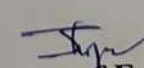
Numerical Differentiation and Integration: Discrete Approximation of Derivatives: Forward and Backward Difference Forms, Numerical Integration: Simson's 1/3, Simson's 3/8. Ordinary Differential Equations: Euler Method, Runge Kutta's Method.

Reference Book:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, P11.1 Learning Pvt. Ltd.
2. Balaguruswamy, Numerical Methods. Tata McGraw Hill Publication, New York.
3. Numerical Methods: R.K. Jain, S.R.K. Iyenger, New Age International Publisher.
4. Higher Engineering Mathematics: B.S. Grewal, Khanna Publisher.


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