



Sunbeam College for Women



Autonomous Post Graduate College
Accredited 'A' Grade by NAAC
BHAGWANPUR, VARANASI-221005 (U.P.)

B.Sc. III Sem.

ACADEMIC PLANNER

2025-26

Physics Syllabus by NEP

Programme/Class: Diploma	Year: Second	Semester: Third
Subject: Physics		
Course Code: BS2510301T	Course Title: Electromagnetic Theory & Modern Optics	
Course Outcomes (COs)		
<ol style="list-style-type: none"> 1. Better understanding of electrical and magnetic phenomenon in daily life. 2. To troubleshoot simple problems related to electrical devices. 3. Comprehend the powerful applications of ballistic galvanometer. 4. Study the fundamental physics behind reflection and refraction of light (electromagnetic waves). 		
Credits: 4	Core Compulsory / Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		
Unit		No. of Lectures
PART A		
Electromagnetic Theory		
Electrostatics		
I	General expression for Electric field in terms of volume charge density, general expression for Electric potential in terms of volume charge density and Gauss law (applications included). Study of electric dipole. Electric fields in matter, polarization, auxiliary field D (Electric displacement), electric susceptibility and permittivity.	8
Magnetostatics		
II	General expression for Magnetic field in terms of volume current density, Ampere's circuital law (applications included). Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetisation, auxiliary field H , magnetic susceptibility and permeability.	8
Time Varying Electromagnetic Fields		
III	Faraday's laws of electromagnetic induction and Lenz's law. Displacement current, equation of Continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included). Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer.	7
Electromagnetic Waves		
IV	Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics, homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law,	7

Sunbeam College for Women, Bhagwanpur

B.Sc. - Third Semester (2025-26)

Physics- Part A (Paper: BS2510301T)

Subject Teacher: Dr. Amit Kumar

Reference Books:					
<p>1. "Introduction to Electrodynamics" by D. J. Griffiths, Publication: Prentice-Hall of India Private Limited, 2002</p> <p>2. "The Feynman Lectures on Physics Vol 2" by Richard P. Feynman, Robert B. Leighton, Matthew Sands, Publication: Pearson Education Limited, 2012</p> <p>3. "Electricity and Magnetism" by D. C. Tayal. Publication: Himalaya Publishing House Private Limited, 2019.</p>					
S.N.	Unit	Month	Week	No. of Lectures	Topics
1.	I	July (06 days)	4 th	3	Electrostatics: General expression for Electric field in terms of volume charge density, General expression for Electric potential in terms of volume charge density.
			5 th	3	Gauss law and its applications
2.	I & II	August (12 Days)	1 st	--	*****
			2 nd	3	Study of electric dipole. Electric fields in matter
			3 rd	3	Polarization, auxiliary field D (Electric displacement). Electric susceptibility and permittivity.
			4 th	3	Magnetostatics: General expression for Magnetic field in terms of volume current density.
			5 th	3	Ampere's circuital law and its applications.
3.	II & III	September (11 Days)	1 st	3	Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter.
			2 nd	3	Magnetisation, auxiliary field H , magnetic susceptibility and permeability.
			3 rd	2	Time Varying Electromagnetic Fields: Faraday's laws of electromagnetic induction and Lenz's law.
			4 th	3	Displacement current, equation of Continuity, Maxwell-Ampere's circuital law.
			5 th	--	*****
4.	III & IV	October (09 Days)	1 st	--	*****
			2 nd	3	Self and mutual induction (applications included). Derivation of Maxwell's equations.

			3 rd	3	Physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer.
			4 th	--	*****
			5 th	3	Electromagnetic Waves: Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics.
5.	IV	November (06 days)	1 st	--	*****
			2 nd	2	Homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media.
			3 rd	3	Reflection and refraction of homogeneous plane electromagnetic waves.
			4 th	1	law of reflection, Snell's law.
			5 th	--	*****

Syllabus

Programme/Class: **Diploma** Year: **Second** Semester: **Third**

Subject: **Physics** Course Code: **BS2510301T**

Course Title: **Electromagnetic Theory & Modern Optics**

Course Outcomes (COs)

1. Better understanding of electrical and magnetic phenomenon in daily life.
2. To troubleshoot simple problems related to electrical devices.
3. Comprehend the powerful applications of ballistic galvanometer.
4. Study the fundamental physics behind reflection and refraction of light (electromagnetic waves).
5. Study the working and applications of Michelson and Fabry-Perot interferometers.
6. Recognize the difference between Fresnel's and Fraunhofer's class of diffraction.
7. Comprehend the use of polarimeters.
8. Study the characteristics and uses of lasers.

Credit: 4

Max.Marks: 25+75

Core compulsory/Elective

Min. Passing Marks:10+25

PART A

Electromagnetic Theory

UNIT-I

Electrostatics

General expression for Electric field in terms of volume charge density, general expression for Electric potential in terms of volume charge density and Gauss law (applications included). Study of electric dipole. Electric fields in matter, polarization, auxiliary field **D** (Electric displacement), electric susceptibility and permittivity.

No. of Lecture: 8

UNIT-II

Magnetostatics

General expression for Magnetic field in terms of volume current density, Ampere's circuital law (applications included). Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetisation, auxiliary field **H**, magnetic susceptibility and permeability.

No. of Lecture: 8

UNIT-III

Time Varying Electromagnetic Fields

Faraday's laws of electromagnetic induction and Lenz's law. Displacement current, equation of continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included). Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer.

No. of Lecture: 7

UNIT-IV

Electromagnetic Waves

Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics, homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law,

No. of Lecture: 7

PART B

Physical Optics & Lasers

UNIT-V

Interference

Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism. Division of Amplitude - Parallel thin film and Newton's Ring experiment. Interferometer - Michelson and Fabry-Perot.

No. of Lecture: 8

UNIT-VI

Diffraction

Distinction between interference and diffraction. Fresnel's and Fraunhofer's class of diffraction. Fresnel's Half Period Zones and Zone plate. Fraunhofer diffraction at a single slit, n slits and Diffracting Grating. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating.

No. of Lecture: 8

UNIT-VII

Polarisation

Polarisation by dichromic crystals,, Nicol prism, Brewster's and Malus law, retardation plates and Babinet's compensator. Analysis of polarized light. Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters.

No. of Lecture: 7

UNIT-VIII

Lasers

Characteristics and uses of Lasers. Quantitative analysis of Spatial and Temporal coherence. Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion).

No. of Lecture: 7

Suggested Readings

PART A

1. D.J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India Private Limited, 2002, 3e
2. E.M. Purcell, "Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2", McGraw Hill, 2017, 2e

3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 2", Pearson Education Limited, 2012

4. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing House Pvt. Ltd., 2019, 4e

PART B

1. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e

2. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e

3. A. Ghatak, "Optics", McGraw Hill, 2017, 6e

Course Prerequisites

Passed semester- I and II

Continuous Internal Evaluation (CIE) Methods (Maximum Marks:25) Proposed Bifurcation of Marks (25) under CIE as follows

Assessment Type	Max. Marks
Class Test	10
Quiz /Seminar/project/Presentation/Research Orientation/ Assignment /Assignment(Char/Flora/Rural services/ Technology/ Dissemination/ Excursions/Lab. Visit/Industrial training).	15

Note: The award for 25 marks will be in integer (for example 12.5=13)

Note: In End semester examination equal weightage should be given to Part A and Part B while framing the question

LECTURE PLAN

Academic session 2025-2026

Class/Section – B.Sc. 2nd [PMC] – 3rd semester

Teacher Name: Dr. Devendra Mohan Upadhyay

Course Name: Part B- Physical Optics & Lasers

Course Code: B010301T

Reference Book:

1. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e
2. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e
3. A. Ghatak, "Optics", McGraw Hill, 2017, 6e
4. Brijlal and subrahmaniam, "Optics", S. Chand &Co.

Lecture Plan

Month	Unit	Week	No. of Planned Lecture	Topic
July	V	1st	---	
		2nd	---	
		3rd	3	Paper1-partB-Unit-V:- Introduction: Interference, Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism.
		4th	3	Division of Amplitude - Parallel thin film, Newton's Ring experiment.
		5th	1	Interferometer - Michelson and Fabry-Perot
August	VI	1st	2	Paper1- part B- Unit- VI:- Diffraction Distinction between interference and diffraction. Fresnel's and Fraunhofer's class of diffraction.
		2nd	2	Fresnel's Half Period Zones and Zone plate.
		3rd	2	Fraunhofer diffraction at a single slit,
		4th	3	Fraunhofer diffraction at n slits and Diffracting Grating
		5th	3	Resolving Power of Optical Instruments - Rayleigh's criterion
September	VII	1st	2	Resolving power of telescope, microscope & grating.
		2nd	3	Paper1-partB-Unit-VII:- Polarisation Polarisation by dichromic crystals, Nicol prism, Brewster's and Malus law,
		3rd	3	retardation plates and Babinet's compensator
		4th	3	Analysis of polarized light. Optical Rotation - Fresnel's explanation of optical rotation
		5th	---	
October	VIII	1st	---	
		2nd	3	Optical Rotation - Fresnel's explanation of optical rotation
		3rd	2	Half Shade & Biquartz polarimeters.
		4th	2	Paper1-partB-Unit-VIII:- Characteristics and uses of Lasers.
		5th	2	Quantitative analysis of Spatial and Temporal coherence.
November		1st	1	Conditions for Laser action
		2nd	3	Conditions for Laser action and Einstein's coefficients.
		3rd	3	Three and four level laser systems
		4th	---	
		5th	---	
Total Number of Class			46	

LECTURE PLAN

Academic session 2025-2026

Class/Section – B.Sc. 2nd [PMC] – 3rd semester

Teacher Name: Dr. Devendra Mohan Upadhyay

Course Name: Part B-Practical

Course Code: B010302P

Lecture Plan				
Month	Unit	Week	No. of Planned Lecture	Topic
July		3rd	2	1. Variation of magnetic field along the axis of single coil 2. Variation of magnetic field along the axis of Helmholtz coil 3. Carey Foster Bridge: Resistance per unit length and low resistance 4. Determine the value of low resistance with the help of Carey's Foster Bridge. 5. Fresnel Biprism: Wavelength of sodium light 6. Fresnel Biprism: Thickness of mica sheet) 7. Newton's Rings: Wavelength of sodium light 8. Newton's Rings: Refractive index of liquid 9. Plane Diffraction Grating: Resolving power 10. Plane Diffraction Grating: Spectrum of mercury light 11. Polarimeter: Specific rotation of sugar solution
		4th	2	Practical proposed and allotted to students.
		5th	2	Practical proposed and allotted to students.
August		1st	0	
		2nd	2	Practical proposed and allotted to students.
		3rd	2	Practical proposed and allotted to students.
		4th	2	Practical proposed and allotted to students.
		5th	2	Practical proposed and allotted to students.
September		1st	2	Practical proposed and allotted to students.
		2nd	2	Practical proposed and allotted to students.
		3rd	2	Practical proposed and allotted to students.
		4th	2	Practical proposed and allotted to students.
		5th	0	
October		1st	0	
		2nd	2	Practical proposed and allotted to students.
		3rd	2	Practical proposed and allotted to students.
		4th	0	Practical proposed and allotted to students.
		5th	2	Practical proposed and allotted to students.
November		1st	0	Practical proposed and allotted to students.
		2nd	2	Practical proposed and allotted to students.
		3rd	2	Practical proposed and allotted to students.
		4th	0	
		5th	0	
Total Number of Class			32	

Semester III, Paper-1 (Theory)
Course Title: Chemical Dynamics & Coordination Chemistry

Programme: Diploma in Chemical Dynamics and Analytical Techniques		Year: Two	Semester: III
Paper-1 Theory		Subject: Chemistry	
Course Code: BS2520301T		Course Title: Chemical Dynamics & Coordination Chemistry	
<p>Course outcomes: Upon successful completion of this course students should be able to describe the characteristic of the three states of matter and describe the different physical properties of each state of matter. kinetic theory of gases, laws of crystallography, liquid state and liquid crystals, conductometric, potentiometric, optical methods, polarimetry and spectrophotometer technique to study Chemical kinetics and chemical equilibrium. After the completion of the course, Students will be able to understand metal- ligand bonding in transition metal complexes, thermodynamic and kinetic aspects of metal complexes.</p>			
Credits: 4		Elective	
Max. Marks: 25+75			
Total No. of Lectures = 60			
Unit	Topics	No. of Lectures	
I	Chemical Kinetics: Rate of a reaction, molecularity and order of reaction, concentration dependence of rates, mathematical characteristic of simple chemical reactions – zero order, first order, second order, pseudo order, half-life and mean life. Determination of the order of reaction – differential method, method of integration, half-life method and isolation method. Brief outline of experimental methods of studying chemical kinetics: Conductometric, potentiometric, optical methods, polarimetry and spectrophotometer Theories of chemical kinetics: Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects (no derivation).	10	
II	Chemical Equilibrium : Equilibrium constant and free energy, thermodynamic derivation of law of mass action. Le-Chatelier's principle. reaction isotherm and reaction isochore – Clapeyron-Clausius equation and its applications.	5	
III	Phase Equilibrium : Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system– water, CO ₂ and systems. Phase equilibria of two component systems – Solid - liquid equilibria, simple eutectic Pb- Ag systems.	05	
IV	Kinetic theories of gases Gaseous State: Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state. Critical phenomena: PV isotherms of real gases, continuity of states, the isotherms of Van der Waals equation, relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state. Molecular Velocities: Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases (based on Joule-Thomson effect).	10	
V	Liquid State Liquid State: Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesterol phases. Thermography and seven segment cell. Liquids in solids (gels): Classification, preparation and properties, inhibition, general application	5	
VI	Coordination Chemistry Coordinate bonding: double and complex salts. Werner's theory of coordination complexes, classification of ligands, ambidentate ligands, chelates, coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers), Isomerism in coordination compounds, constitutional and stereo isomerism, geometrical and optical isomerism in square planar and octahedral complexes.	5	

VII	Theories of Coordination Chemistry I Metal- ligand bonding in transition metal complexes, limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.	10
	II. Thermodynamic and kinetic aspects of metal complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes	
VIII	Inorganic Spectroscopy and Magnetism I) Electronic spectra of Transition Metal Complexes Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.	10
	II) Magnetic properties of transition metal complexes, types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes. Magnetic properties paramagnetism, diamagnetism and ferromagnetism, magnetic susceptibility, its measurements and its importance.	

Suggested Readings:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 13 (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Cotton, F.A, Wilkinson, G and Gaus, P. L ,Basic Inorganic Chemistry, 3rd Edition ,Wiley 1995
5. Lee, J.D, Concise Inorganic Chemistry 4th Edition ELBS, 1977
6. Douglas, B, McDaniel, D and Alexander, J ,Concepts of Models of Inorganic Chemistry, John Wiley & Sons; 3rd edition , 1994
7. Shriver, D.E Atkins, P.W and Langford, C.H , Inorganic Chemistry ,Oxford University Press, 1994.
8. Porterfield, W.W, Inorganic Chemistry ,Addison Wesley 1984.
9. Sharpe, A.G, Inorganic Chemistry, ELBS, 3RD edition ,1993
10. Miessler, G.L, Tarr, D.A, Inorganic Chemistry, 2nd edition , Prentice Hall, 2001

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

Suggestive digital platforms web links-

Suggestive digital platforms web links:

11. <https://swayam.gov.in/>
12. <https://www.coursera.org/learn/physical-chemistry>
13. <https://www.mooc-list.com/tags/physical-chemistry>
14. <https://www.openlearning.com/courses/introduction-to-physical-chemistry/>
15. <https://www.my-mooc.com/en/categorie/chemistry>
16. https://onlinecourses.swayam2.ac.in/nce19_sc15/preview
17. <https://swayam.gov.in/>
18. <https://www.coursera.org/browse/physical-science-and-engineering/chemistry>

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Quiz/Seminar/Project/Presentation/Research Orientation Assignment/ Assignments (Charts/Flora/Rural Service/Technology Dissemination/Excursions/Lab Visits/Industrial training)	15

LECTURE PLAN

Academic session 2025-2026

Class– B.Sc. – III Semester(BZC)

Teacher Name: Dr. Chhaya Pandey

COURSE CODE: B020301TCourse

Title: Chemical dynamics & Coordination Chemistry

Lecture Plan				
Month	Unit	Week	No. of Planned Lecture	TOPIC
July		4th	1	Chemical Kinetics ,Rate law order and molecularity of reaction
		5th	2	Mathematical characteristic of simple chemical reaction,First order reaction.and zero order reaction
August	I	1st	2	Mathematical characteristic of simple chemical reaction, Second order reaction and pseudo order reaction.
		2nd	2	Half-life and mean life. Determination of the order of reaction – differential method, method of integration, half-life method & isolation method.
		3rd	2	Brief outline of experimental methods of studying chemical kinetics: Conductometric, potentiometric, optical methods, polarimetry and spectrophotometer
		4th	3	Theories of chemical kinetics: Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects (no derivation).
		5th	3	Chemical Equilibrium : Equilibrium constant and free energy, thermodynamic derivation of law of mass action. Le-Chatelier's principle. reaction isotherm and reaction isochore – Clapeyron- Clausius equation and its applications.
September		1st	2	Phase Equilibrium : Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, .
		2nd	3	Phase Equilibrium : Phase equilibria of one component system– water & CO ₂ .
		3rd	2	Phase Equilibrium : Phase equilibria of two component systems – Solid – liquid equilibria , simple eutectic – Pb- Ag systems.
		4th	3	Phase Equilibrium : Phase equilibrium simple eutectic – Pb-Ag systems.
		5th	zero	---
October		1st	1	critical phenomena: PV isotherms of real gases, continuity of states, the isotherms of Van der Waals equation.
		2nd	3	Relationship between critical constants and Van der Waals constants, the law of corresponding states, reduced equation of state. Molecular Velocities: Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases (based on Joule- Thomson effect).
		3rd	2	Molecular Velocities: Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases (based on Joule- Thomson effect)
		4th	2	Liquid State: Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases.
		5th	2	Liquid State Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesterol phases. Thermography and seven segment cell. Liquids in solids (gels): Classification, preparation and properties, inhibition, general applicatio
November	III	1st	3	Thermography and seven segment cell. Liquids in solids (gels): Classification, preparation and properties, inhibition, general applicatio
		2nd	3	Numerical problem from chemical kinetics& revision class
		3rd	1	Numerical problem from chemical kinetics& revision class

LECTURE PLAN

Academic session 2025-2026

Class/Section – B.Sc. [PMC&BZC] – 3rd Semester

Teacher Name: Dr. Arun Kumar Upadhyay

Course Name: Chemical Dynamics & Coordination Chemistry

Course Code: B020301T

Lecture Plan				
Month	Unit	Week	No. of Planned Lecture	Topic
July	VI	3rd	1	Coordinate bonding: double and complex salts
		4th	3	Werner's theory of coordination complexes, classification of ligands,
		5th	3	Ambidentate ligands, chelates, coordination numbers coordination sphere
August	VI	1st	0	-
		2nd	3	IUPAC nomenclature of coordination complexes (up to two metal centers) Isomerism in coordination compounds
		3rd	3	Constitutional and stereo isomerism geometrical and optical isomerism in square planar and octahedral complexes
		4th	3	limitations of valence bond theory, an elementary idea of crystal field theory
		5th	3	Crystal field splitting in octahedral & tetrahedral and square planar complexes
September	VII & VIII	1st	3	Factors affecting the crystal-field parameters.
		2nd	3	A brief outline of thermodynamic stability of metal complexes and factors affecting the stability
		3rd	2	Stability constants of complexes and their determination, substitution reactions of square planar complexes
		4th	3	Electronic spectra of transition metal complexes-Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series
		5th	0	-
October	VIII	1st	0	-
November	VIII	2nd	3	Orgel-energy level diagram for d1 and d9 states , Discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.
		3rd	3	Magnetic properties of transition metal complexes, types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula, L-S coupling,
		4th	1	Correlation of μ_s and μ_{eff} values
		5th	3	Orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes
		1st	0	-
		2nd	2	Magnetic properties paramagnetism, diamagnetism and ferromagnetism
		3rd	3	Magnetic susceptibility, its measurements and its importance

Books:

1. Cotton, F.A, Wilkinson, G and Gaus, P. L, Basic Inorganic Chemistry, 3rd Edition, Wiley 1995
2. Lee, J.D, Concise Inorganic Chemistry 4th Edition ELBS, 1977
3. Douglas, B, McDaniel, D and Alexander, J, Concepts of Models of Inorganic Chemistry, John Wiley & Sons; 3rd edition, 1994
4. Shriver, D.E Atkins, P.W and Langford, C.H, Inorganic Chemistry, Oxford University Press, 1994.
5. Porterfield, W.W, Inorganic Chemistry, Addison Wesley 1984.
6. Sharpe, A.G, Inorganic Chemistry, ELBS, 3RD edition, 1993
7. Miessler, G.L, Tarr, D.A, Inorganic Chemistry, 2nd edition, Prentice Hall, 2001
8. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
9. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.

Semester III, Paper-2 (Practical):
Course Title: Physical Analysis

Programme: Diploma in Chemical Dynamics and Analytical Techniques	Year: Two	Semester: III
Practical paper-2		Subject: Chemistry
Course Code: BS2520302P	Course Title: Physical Analysis	
Course Outcomes: Upon successful completion of this course students should be able to calibrate apparatus and prepare solutions of various concentrations, estimation of components through volumetric analysis; to perform dilatometric experiments: one and two component phase equilibrium experiments.		
Credits: 4	Elective	
Max. Marks: 25 +75		
Practical		60 h
Unit	Topics	No of Lectures
I	Strengths of Solution Calibration of fractional weights, pipettes and burettes. Preparation of standards solutions. Dilution – 0.1 M to 0.001 M solutions. Mole Concept and Concentration Units :Mole Concept, molecular weight, formula weight, and equivalent weight. Concentration units: Molarity, Formality, Normality, Molality, Mole fraction, Percent by weight, Percent by volume, Parts per thousand, Parts per million, Parts per billion, pH, pOH, milli equivalents, Milli moles	20
II	Surface Tension and Viscosity 1. Determination of surface tension of pure liquid or solution 2. Determination of viscosity of liquid pure liquid or solution	06
III	Boiling point and Transition Temperature 1. Boiling point of common organic liquid compounds ANY FIVE <i>n</i> butylalcohol, cyclohexanol, ethyl methyl ketone, cyclohexanone, acetylacetone, isobutyl methyl ketone, isobutyl alcohol, acetonitrile, benzaldehyde and acetophenone. [Boiling points of the chosen organic compounds should preferably be within 180°C]. 2. Transition Temperature, Determination of the transition temperature of the given substance by thermometric /dilatometric method (e.g. MnCl ₂ .4H ₂ O/SrBr ₂ .2H ₂ O)	14
IV	Phase Equilibrium	20

- | | |
|---|--|
| 1. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenolwater system) and to determine the concentration of that solute in the given phenol-water system | |
| 2. To construct the phase diagram of two component (e.g. diphenylamine – benzophenone) system by cooling curve method. | |

Suggested Readings:

1. Skoog .D.A., West.D.M and Holler .F.J., “Analytical Chemistry: An Introduction”, 7th edition, Saunders college publishing, Philadelphia,(2010).
2. Larry Hargis.G” Analytical Chemistry: Principles and Techniques” Pearson©(1988)

Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University

Suggestive digital platforms web links

1. <https://www.labster.com/chemistry-virtual-labs/>
2. <https://www.vlab.co.in/broad-area-chemical-sciences>
3. <http://chemcollective.org/vlabs>

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Quiz/Seminar/Project/Presentation/Research Orientation Assignment/ Assignments (Charts/Flora/Rural Service/Technology Dissemination/Excursions/Lab Visits/Industrial training)	15

LECTURE PLAN

Academic session 2025-2026

Class/Section – B.Sc. [PMC&BZC] – 3rd Semester

Teacher Name: Dr. Arun Kumar Upadhyay

Course Name: Physical Analysis (Practical)

Course Code: B020302P

Lecture Plan				
Month	Unit	Week	No. of Planned Lecture	Topic
July	I	3 rd	2	Strengths of Solution Calibration of fractional weights, pipettes and burettes
		4 th	2	Preparation of standards solutions. Dilution -0.1 M to 0.001 M solutions.
		5 th	0	-
August	I & II	1 st	2	Mole Concept and Concentration Units: Mole Concept, molecular weight, formula weight, and equivalent weight.
		2 nd	2	Concentration units: Molarity, Formality, Normality, Molality, Mole fraction
		3 rd	2	Percent by weight, Percent by volume, Parts per thousand, Parts per million
		4 th	2	Parts per billion, pH, pOH, milli equivalents, Milli moles
		5 th	2	Determination of surface tension of pure liquid or solution
September	II & IV	1 st	0	-
		2 nd	2	Determination of viscosity of liquid pure liquid or solution
		3 rd	2	To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system
		4 th	2	To construct the phase diagram of two component (e.g. diphenylamine - benzophenone) system by cooling curve method.
		5 th	0	-
October	III	1 st	0	-
		2 nd	2	Discussion and viva preparation of the above practical's
		3 rd	2	Boiling point of common organic liquid compounds ANY FIVE [nbutylalcohol, cyclohexanol, ethyl methyl ketone,
		4 th	2	Boiling point of common organic liquid compounds acetonitrile, benzaldehyde and acetophenone. [Boiling points of the chosen organic compounds should preferably be within 1800C].
		5 th	2	Boiling point of common organic liquid compounds -cyclohexanone, acetylacetone, isobutyl methyl ketone, isobutyl alcohol,
November		1 st	0	-
		2 nd	2	Transition Temperature, Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. MnCl ₂ .4H ₂ O/SrBr ₂ .2H ₂ O)
		3 rd	2	Preparation for practical examination

Books:

1. Skoog .D.A., West.D.M and Holler .F.J., "Analytical Chemistry: An Introduction", 7th edition, Saunders college publishing, Philadelphia,(2010).
2. Larry Hargis.G" Analytical Chemistry: Principles and Techniques" Pearson©(1988)

B.Sc. II (SEMESTER-III) PAPER-I Algebra & Mathematical Methods

Programme: Diploma Class: B.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Code: BS2530301T	Course Title: Algebra & Mathematical Methods	
Course outcomes:		
<p>CO1: Group theory is one of the building blocks of modern algebra. Objective of this course is to introduce students to basic concepts of Group, Ring theory and their properties.</p> <p>CO2: A student learning this course gets a concept of Group, Ring, Integral Domain and their properties. This course will lead the student to basic course in advanced mathematics and Algebra.</p> <p>CO3: The course gives emphasis to enhance student's knowledge of functions of two variables, Laplace Transforms, Fourier Series.</p> <p>CO4: On successful completion of the course students should have knowledge about higher different mathematical methods and will help him in going for higher studies and research.</p>		
Credits: 6	Core Compulsory / Elective	
Max. Marks: 25+75		
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0		
Part- A Algebra		
Unit	Topics	No. of Lectures
I	Equivalence relations and partitions, Congruence modulo n , Definition of a group with examples and simple properties, Subgroups, Generators of a group, Cyclic groups.	12
II	Permutation groups, Even and odd permutations, The alternating group, Cayley's theorem, Direct products, Coset decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems	11
III	Normal subgroups, Quotient groups, Homomorphisms and isomorphisms, Fundamental theorem of homomorphism, Theorems on isomorphism.	11
IV	Rings, Subrings, Integral domains and fields, Characteristic of a ring some properties, left ideal, right ideals & ideals, properties of ideals, principal ideal, principal ideal domains (definition & examples only), Quotient rings.	11

Suggested Readings(Part-A Algebra)

1. J. B. Fraleigh, A first course in Abstract Algebra, Addison-Wiley.
2. I. N. Herstein, Topics in Algebra, John Wiley & Sons.
3. J. A. Gallian, Contemporary Abstract Algebra, Fourth edition, Narosa Publishing House.
4. R. Lal, Algebra-1 (Group, Rings & Fields), Infosys series of Mathematical Sciences, Springer.
5. Suggested digital plate form: NPTEL/SWAYAM/MOOCs
6. Course Books (text/reference) published in Hindi may be prescribed by the Universities at local levels.

Sunbeam College for Women, Bhagwanpur

B.Sc. - Third Semester (2025)

Math- Part A (Paper: Algebra)

Subject Teacher: Dharmendra Dubey

S.N.	Unit	Month	Week	No. of Lectures	Topics
1.	I	July	3	2	Equivalence relations and partitions, Congruence modulo n.
			4	4	Definition of a group with example and simple properties
			5	3	Definition of a group with example and simple properties
2.	I	August	1 st	1	Permutation group, sub group
			2 nd	4	Permutation group, sub group
			3 rd	4	Permutation group, sub group
			4 th	4	Cyclic groups, Coset decomposition
			5 th	3	Coset decomposition, lag ranges theorem and its con sequences
3.	II	September	1 st	4	Coset decomposition, lag ranges theorem and its con sequences
			2 nd	4	Fermat and Euler theorems
			3 rd	3	normal subgroups, quotient group
			4 th	4	normal subgroups, quotient group
			5 th	-	
4.	III	October	1 st	-	
			2 nd	4	normal subgroups, quotient group.
			3 rd	3	normal subgroups, quotient groups.
			4 th	1	Homomorphisms and isomorphisms
			5 th	3	Homomorphisms and isomorphisms
5.	VIII	Nov	1 st	-1	Fundamental theorem of homomorphism
			2 nd	3	Theorems on isomorphism
			3 rd	4	Theorems on isomorphism
			4 th	1	direct product.

Total Number of Classes-60

PART-B Geometry		
Unit	Topics	No. of Lectures
V	General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	12
VI	Three-Dimensional Coordinates, Direction Cosines & Ratios, Projections, Planes (Cartesian and vector form), Straight lines in three dimensions.	11
VII	Sphere, Cone and Cylinder.	15
VIII	Central conicoids, Paraboloids.	7

Suggested Readings(PART-A Matrices and Differential Equations):

1. Stephen H. Friedberg, A. J Insel & L.E. Spence, Linear Algebra, Person.
2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa.
3. D.A. Murray, Introductory Course in Differential Equations, Orient Longman.
4. A. C. Yadav, Matrices & Linear Algebra with GAP, Educreation Publishing.
5. Suggested digital plate form: NPTEL/SWAYAM/MOOCs.
6. M. D. Rai Singhania, Ordinary and Partial Differential Equations, S. Chand Pub.
7. Krishna Publications.

Suggested Readings (Part-B Geometry):

8. Robert J. T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.
9. P. R. Vittal, Analytical Geometry 2d & 3D, Pearson.
- 10.S. Narayan & P. K. Mittal, 3-dimensional Geometry, S. Chand.
- 11.S. L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.
- 12.Suggested digital platform: NPTEL/SWAYAM/MOOCs.
- 13.Krishna Publications

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Quiz/Seminar/Project/Presentation/Research Orientation Assignment/ Assignments (Charts/Flora/Rural Service/Technology Dissemination/Excursions/Lab Visits/Industrial training)	15

Sunbeam College for Women, Bhagwanpur, Varanasi

B. Sc. III Semester (Session: 2025-26)

Mathematical Methods (Course Code: BS2530301T)

Subject Teacher: Dr. Manish Srivastava

Lecture Plan

Sl. No.	Unit	Month	Week	No. of Lectures	Topics
1	III	July	3rd	3	Existence theorems for Laplace transforms, Linearity of Laplace transform and their properties.
			4th	4	Laplace transform of the derivatives and Integrals of a function.
			5th	1	Problem based on Laplace transform.
2	III & IV	August	1st	3	Convolution theorem, Inverse Laplace transforms, Solution of differential equation using Laplace transform.
			2nd	2	Fourier series, Fourier Transforms (Infinite).
			3rd	1	Fourier Transforms and Its theorem
			4th	4	Finite Fourier Transforms, Fourier integral.
			5th	4	Fourier Expansion of piece wise monotonic function, Half and Full range expansions.
3	I	September	1st	3	Limit of functions of two variables and its problems.
			2nd	4	Continuity of functions of two variables and its problems, Differentiation of function of two variables.
			3rd	4	Necessary and sufficient condition for differentiability of functions two variables.
			4th	4	Schwarz's and Young theorem
4	II	October	2nd	4	Taylor's theorem for functions of two variables, Maxima and minima.
			3rd	2	Problems on Maxima and Minima.
			4th	3	Lagrange's multiplier method.
			5th	3	Jacobians.

Suggested Readings:

1. S. Naryan & P.K. Mittal (S Chand Publication)
2. HK Dass, Rama Verma
3. Manish Srivastava (Krishna Publication)

Diploma in Plant Identification, Utilization & Cytogenetics				
III	BS2540301T	Flowering Plants Identification & Aesthetic Characteristics	Theory	4
	BS2540302P	Plant Identification technology	Practical	2

Syllabus – Dr. Ekta Shukla

Programme /Class: Diploma in Plant Identification, Utilization & Cytogenetics		Year: II	Semester: III Paper-I
Subject: Botany			
Course Code: BS2540301T		Course Title: Flowering Plants Identification & Aesthetic Characteristics	
<p>Course outcomes: After the completion of the course the students will be able to:</p> <ol style="list-style-type: none"> To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification. To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants. To compare the different approaches to classification with regard to the analysis of data. To become familiar with major taxa and their identifying characteristics, and to develop in depth knowledge of the current taxonomy of a major plant family. To discover and use diverse taxonomic resources, reference materials, herbarium collections, publications. For the entrepreneur career in plants, one can establish a nursery, start a landscaping business, set up a farm or run a plantation consultancy firm 			
Credits: 4		Core Compulsory	
Max. Marks: 25+75		Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Unit	Topic		No. of Lectures (60hrs)
IV	<p>Identification of Angiospermic families -II: A study of the following families with emphasis on the morphological peculiarities and economic importance of its members (based on Bentham & Hooker's system)- Solanaceae, Apiaceae, Amaranthaceae, Euphorbiaceae, Papaveraceae, Orchidaceae, Liliaceae, Asteraceae, and Poaceae.</p>		7
V	<p>Modern trends in Plant taxonomy: Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy- methods, Operational Taxonomic Units. Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.</p>		8
VI	<p>TOOLS & SOFTWARES IN PLANT IDENTIFICATION- GIS Mapping of (i) Patterns(ii) Features (iii) Quantities 0P02.010PHYLIP - Free Phylogenetic Software, Digital Taxonomy, Description Language for Taxonomy – DELTA Internet Directory for botany</p>		7
VII	<p>Computer Applications Introduction to Computers- classification, computer generation, software and hardware, operating systems, personal, mini, main frame and super computers, characteristics and application, computer memory and its types, data representation and storage and number systems. Microsoft excel, data entry, graphs, aggregate functions.</p>		7

Suggested Readings:**Course Books published in Hindi may be prescribed by the Universities.**

1. K. B. Anjaria, (2015) "Electronic Herbarium and Digital Database Preparation of Common Trees of Anand District, Gujarat" MRP submitted to UGC, WRO, Pune 2015 (unpublished)
2. Lizeron Eremias and R. Subash. (2013) "E-Content Development: A Milestone In The Dynamic Progress Of E- Learning" International Journal of Teacher Educational Research (IJTER) Vol.2 No.1 January, 2013 ISSN: 2319- 4642
3. Pandey, B.P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi.
4. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.
5. Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
6. Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.
7. Austin, R. 2002. Elements of planting design. New York: John Wiley & Sons.
8. Bertauski, T. 2005. Designing the landscape: An introductory guide for the landscape designer. Upper Saddle River, NJ: Pearson Prentice Hall.
9. Thomas, H., and S. Wooster. 2008. The complete planting design course: Plans and styles for every garden. London: Octopus Publishing Group.
10. Scarfone, S. 2007. Professional planting design: An architectural and horticultural approach for creating mixed bed plantings. New York: John Wiley & Sons.
11. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
12. Singh, Pande, Jain (2017-2018) Diversity of Angiosperms, Rastogi publication, Meerut
13. B.P, Pandey Botany for B.Sc. Students S. Chand, New Delhi
14. Guru Charan Singh (2020) Plant Systematics CBS Publication New Delhi
15. S.K. Gupta (2020) Flowering Plants Identification and Aesthetic Characteristics Kedarnath Publication Meerut.

This course can be opted as an elective by the students of following subjects: Open to all but special for B.Sc. Biotech, B.Sc. Forestry, B.Sc. Agriculture, B. Pharma, B.A. (Curators), B.A. Archaeology, B.A. Geology, BAMS

Suggested Continuous Evaluation Methods:

Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Internal Assessment	Marks
Class Test	10
Quiz/ Seminar/ Presentation/ Assignment (Charts/ Flora/ Rural Service/ Technology Dissemination/Research Orientation assignment/Lab Visits/Excursion/Industrial Training)	15
	25

Course prerequisites:

Qualification: To study this course, a student must have qualified 10+2 with Biology/ NSQF level 3 from Sector Skill Councils / Diploma holder from ITI in (Biology/ Agriculture/ Forestry).

Facilities: Smart and Interactive Class

Other Requisites: Video collection, Books, CDs, Flora, Herbarium, Access to On-line resources, Display Charts

Suggested equivalent online courses: <https://www.easybiologyclass.com/topic-botany/> <http://egyankosh.ac.in/handle/123456789/53530> <https://www.delta-intkey.com/www/desc.htm> <https://milneorchid.weebly.com/plant-id-for-beginners.html> <https://plants.usda.gov/classification.html> https://www.senecahs.org/pages/uploaded_files/Plant%20Classification.pdf https://www.ladykeanecollege.edu.in/files/userfiles/file/Dr_%20S_%20Nongbri%20III%20Sem%20ppt.pdf https://www.brainkart.com/article/Bentham-and-Hooker-s-classification-of-plants---Dicotyledonae,-Gymnospermae- and-Monocotyledonae_1000/ <https://libguides.rutgers.edu/c.php?g=336690&p=2267037> <https://www.delta-intkey.com/>

Sunbeam College for Women, Bhagwanpur					
BOTANY					
B.Sc Botany III Semester Session 2025-2026					
Course Code/ Title- BS2540301T Flowering Plants Identification & Aesthetic Characteristics					
Dr. Ekta Shukla					
Reference Books:					
Plant systematics- Gurucharan Singh					
Plant Taxonomy- O.P. Sharma					
Flowering Plants Identification and Aesthetic characteristics- Dr. S.k Gupta					
Flowering Plants and Aesthetic Characteristics- Singh, Pande, Jain					
S.No.	Unit	Month	Week	No. of Lectures	Topics
1	V	July (27 days)	3	1	Introductory Class- Phenetics and Cladistics
			4	3	Brief Idea on Phenetics, Numerical taxonomy- methods
			5	3	Operational taxonomic units, Cladistics- Construction of cladogram, primary analysis
			1st	0	
			2nd	3	Methods of Cladistics
					Grouping of Species as per cladistics
					Cladistics- Construction of cladogram
			3rd	3	Monophyletic, polyphyletic and paraphyletic groups
					Pleisomorphy and Apomorphy
			2	IV+V+VI	AUGUST (24 Days)
PHYLIP SOFTWARE- Description					
Digital Taxonomy, DDescription Language for TAXonomy – DELTA					
5th	3	Internet directory for botany			
		Identification of Angiospermic family -I: A study of the following families with emphasis on the morphological peculiarities and economic importance of its members Solanaceae			
3	IV	SEPTEMBER (22 Days)	1st	3	Family- Apiaceae
					Family-Apiaceae
					Family-Euphorbiaceae
			2nd	3	Family-Euphorbiaceae
					Family - Papaveraceae
					Family - Papaveraceae
			3rd	2	Family- Amaranthaceae
					Family- Amaranthaceae
			4th	3	Family- Orchidaceae
					Family- Orchidaceae
					Family- Liliaceae

4	IV+VII	OCTOBER (18 days)	1st	0	
			2nd	3	Family- Liliaceae
					Family- Liliaceae
					Family -Areceaceae
			3rd	3	Family -Areceaceae
					Family- Poaceae
					Family- Poaceae
			4th	0	
			5th	3	Introduction to Computers – classification, computer generation, low, medium and high level languages, software and hardware, operating systems
					compilers and interpreters, personal, mini, main frame and super computers, characteristics and application, computer memory and its types, data representation and storage
Microsoft excel, data entry, graphs, aggregate functions, formulas and functions					
5	IV +VII	NOVEMBR (13 Days)	1st	0	
			2nd	2	Microsoft Excel- number systems, conversion devices, secondary storage media
					Left over topics
			3rd	3	Left over topics
					Left over topics
					Left over topics

Diploma in Plant Identification, Utilization & Cytogenetics				
III	BS2540301T	Flowering Plants Identification & Aesthetic Characteristics	Theory	4
	BS2540302P	Plant Identification technology	Practical	2

Syllabus - Dr. Yashveer Singh

Programme /Class: Diploma in Plant Identification, Utilization & Cytogenetics		Year: II	Semester: III Paper-I
Subject: Botany			
Course Code: BS2540301T		Course Title: Flowering Plants Identification & Aesthetic Characteristics	
<p>Course outcomes: After the completion of the course the students will be able to:</p> <ol style="list-style-type: none"> To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification. To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants. To compare the different approaches to classification with regard to the analysis of data. To become familiar with major taxa and their identifying characteristics, and to develop in depth knowledge of the current taxonomy of a major plant family. To discover and use diverse taxonomic resources, reference materials, herbarium collections, publications. For the entrepreneur career in plants, one can establish a nursery, start a landscaping business, set up a farm or run a plantation consultancy firm 			
Credits: 4		Core Compulsory	
Max. Marks: 25+75		Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0			
Unit	Topic		No. of Lectures (60hrs)
I	Taxonomic Resources & Nomenclature Components of taxonomy (identification, nomenclature and classification); Taxonomic resources: a. Herbarium- functions & important herbaria, b. Botanical gardens, c. Flora, d. Taxonomic keys- single access and multi-access. Botanical Nomenclature- Principles and rules of ICN (ranks and names; principle of priority, binomial system; type method, author citation, valid-publication etc.).		8
II	Types of classification & Evidences Artificial, natural and phylogenetic systems of classification. Bentham and Hooker (up to series), Engler and Prantl (up to series), Angiosperm phylogeny group (APG IV) classification. Taxonomic evidences from Palynology, Cytology, Phytochemistry & Molecular biology data (Protein and Nucleic acid homology).		7
III	Identification of Angiospermic families -I: A study of the following families with emphasis on the morphological peculiarities and economic importance of its members (based on Bentham & Hooker's system) - Ranunculaceae, Malvaceae, Rutaceae, Fabaceae, Myrtaceae, Cucurbitaceae, Rubiaceae Apocynaceae and Lamiaceae.		8
VIII	Aesthetic Characteristics of Plants: Aesthetic characteristics of plants -English, Italian, French, Persian, Mughal and Japanese gardens. Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Trees, shrubs and shrubberies, climbers and creepers, rockery, flower beds). Some Famous gardens of India. Conservatory, green houses, Indoor Garden, Roof Garden, Topiary and Bonsai		8

Sunbeam College for Women, Bhagwanpur
B.Sc. - III Semester [BOTANY] Lecture Plan of Dr. Yashveer Singh

Session- 2025-26					
Course Code/ Title- BS2540301T, Flowering Plants Identification & Aesthetic Characteristics					
Reference Books:					
Plant systematics- Gurucharan Singh					
Plant Taxonomy- O.P. Sharma					
Flowering Plants Identification and Aesthetic characteristics- Dr. S.k Gupta					
Plant Taxonomy and Aesthetic Characters -B.P. Pandey, S.Chand Publication					
Flowering Plants and Aesthetic Characteristics- Singh, Pande, Jain					
S.No	Unit	Month	Week	No. of Lectures	Topics
1	I	JULY (27 Days)	3rd	2	Components of taxonomy
					Taxonomic resources: Herbarium and its functions
			4th	4	Botanical Gardens and its functions
					Taxonomic Resource- Flora
					Taxonomic Keys Single access and multiaccess
					BIONOMIAL NOMENCLATURE- Characteristics
			5th	2	Principles and Rules of Botanical Nomenclature According to ICN (ICBN) - Ranks & Names
Principles of priority, binomial system, types, Author Citation, valid publication.					
2	I, II & III	AUGUST (24 days)	1st	2	Artificial, Natural and Phylogenetic system of classification - Theophrastus & C. Linnaeus
					Bentham and Hooker's system (upto series) of classification
			2nd	3	Merit and Demerits of system
					Engler and Prantl's System (Upto series) of classification
					Engler and Prantl's System - Its Merit and Demerits.
			3rd	2	Angiosperm Phylogeny Group (APG-IV) Classification
					Introduction to taxonomic evidences from palynology, cytology
			4th	4	Introduction to taxonomic evidences from phytochemistry
					Molecular Biology Data, (Protein and Nucleic acid homology)
					Identification of Angiospermic families - I based on Bentham and Hooker's System
					Morphological Peculiarities and economic importance of the following families members- Ranunculaceae
			5th	4	Family- Ranunculaceae
					Family- Malvaceae
Family- Malvaceae					
Family- Rutaceae,					

3	III & IV	SEPTEMBER (22 Days)	1st	3	Family- Rutaceae,
					Family - Fabaceae
					Family - Fabaceae
			2nd	4	Family - Myrtaceae ,
					Family - Myrtaceae ,
					Family - Myrtaceae ,
					Family-Cucurbitaceae
			3rd	3	Family-Cucurbitaceae
					Family Rubiaceae
			4th	4	Family Rubiaceae
					Family Asteraceae
					Family Asteraceae
Family Apocynaceae					
5th	0				
4	III, IV & VIII	OCTOBER (18 Days)	1st	1	Family Apocynaceae
			2nd	4	Family Lamiaceae
					Family Lamiaceae
					Family Apiceae
					Family Apiceae
			3rd	3	Family - Euphorbiaceae
					Family - Euphorbiaceae
					Aesthetic Characterstics of Plants- English, Italian
			4th	2	Aesthetic Characterstics of Plants- French, Persian
					Aesthetic Characterstics of Plants- Mughal, Japanese
			5th	3	Garden wall, Fencing, Steps, Hedge,
					Edging, Lawn, Trees,
shrubs and shrubberies					
5	VIII	NOVEMBER (24 days)	1st	1	climbers and creepers
			2nd	3	rockery, Flower beds, Shrubbery, Borders, Water garden
					Some Famous gardens of India.
					Conservatory
			3rd	4	Green houses
					Indoor garden
					Roof garden, Topiary, Bonsai
					LEFT OVER TOPICS
			4th	1	REVISION

Programme/Class: Diploma in Plant Identification, Utilization & Cytogenetics	
Subject: Botany	
Course Code: BS2540302P	
Course outcomes: After the completion of the course the students will be able:	
<ol style="list-style-type: none"> To learn how plant specimens are collected, documented, and curated for a permanent record. To observe, record, and employ plant morphological variation and the accompanying descriptive terminology. To gain experience with the various tools and means available to identify plants. To develop observational skills and field experience. To identify a taxonomically diverse array of native plants. To recognize common and major plant families. To Understand aesthetic characters of flowering plants by making-landscapes, gardens, bonsai, miniatures Comprehend the concepts of plant taxonomy and classification of Angiosperms. 	
Credits: 2	
Max. Marks: 25+75	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-2	
Unit	Topic
I	Herbarium: Plant collection, Preservation and Documentation: Stepwise Practicing for the Preparation of Herbarium: a. Field Equipments- Global Positioning System (GPS) instrument & collection of any 20 wild plant specimens. b. Learn to handle the Herbarium making tools c. Pressing and Drying of collected plant specimens d. Special treatments for all varied groups of plants e. Mounting on standard herbarium sheets f. Label the sheet using Standard method g. Organize and give Index Register Number
II	Taxonomic Identification using plant characteristics To study the taxonomic description (Plant Morphology, Anatomy, Reproductive parts, Habit and adaptation anomalies) according to Bentham's Hooker system of classification in the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Lamiaceae, Rubiaceae and Asteraceae.
III	Taxonomic Identification using plant characteristics To study the taxonomic description (Plant Morphology, Anatomy, Reproductive parts, Habit and adaptation anomalies) according to Bentham's Hooker system of classification in the following families: Apiaceae, Euphorbiaceae, Poaceae, Apocynaceae, Rutaceae and Ranunculaceae.
IV	Identification during excursions Conducting Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided) and making field note book and filling Sample of a page of field-book, used as in Botanical Survey of India. Collection and preservation of bryophytes and pteridophytes (two each)
V	Botanical Nomenclature & reporting Method: Describe/compare four flowers in semi-technical language giving V.S. of flowers, T.S. of ovaries, floral diagrams and Floral Formulae. Identify and assign them to their respective families giving reasons.
VI	COMPUTERS <ol style="list-style-type: none"> Learning to use Excel, Microsoft PowerPoint and Word., working with folder and windows utility., create and manage files and folder tree, Practice browsing of different sites using search engine. practice and understand different E-Mail services – Outlook, Yahoo mail, rediffmail etc. Practice Creating E-Mail accounts, Sending, Receiving & Storing of mails. Create and participate in virtual conferencing in an interactive Zoom Meeting
VII	Computer Application in taxonomy <ol style="list-style-type: none"> Practical on Phylogenetic analysis Using of plant identification apps on android phones
VIII	Aesthetic Characteristics of Plants: <ol style="list-style-type: none"> Create a Bonsai of any plant (Demo) Develop a miniature garden (Demo) Plant Propagation methods practice (Demo)
Suggested Readings: <i>Course Books published in Hindi may be prescribed by the Universities.</i>	
<ol style="list-style-type: none"> Day, S.C. (2003) A Art of Miniature Plant Culture. - Agrobias. Jodhpur, India. Practical Taxonomy of Angiosperms By: R K Sinha ISBN: 9789386768520 I.K International Publishing House Pvt. Ltd. Day, S.C. (2003) Complete Home Gardening. (2003) Agrobias, Jodhpur, India. 	

4. Khan, M.R. (1995) Horticulture and Gardening. – Nirali Prakashan, Pune. India
5. Kumarsen V. Horticulture Saras Publication
6. Ramesh Bangia Learning Computer Fundamentals.,, Khanna Book Publishers
7. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
8. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers
9. Womersley, J. S. 1981. Plant collecting and herbarium development: A manual.
10. Manilal, K. S. and M. S. Muktesh Kumar (ed.) (1998) A Hand book of Taxonomy Training, DST, N. Delhi
11. Naik, V. N. (1984) Taxonomy of Angiosperms Tata McGraw-Hill Publication Com. Ltd., New Delhi
12. Singh, G (2004) Plant Systematics: Theory and practice Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi
13. De Vogel, E.F. 1987. Manual of Herbarium Taxonomy: Theory and Practice. UNESCO, Jakarta.
14. Jain, S.K. & R.R. Rao. 1977. A handbook of field and herbarium methods. Today & Tomorrow's Printers and Publishers, New Delhi.
15. Fosberg, F.R. & M.-H. Sachet. 1965. Manual for tropical herbaria. Int. Bur. Pl. Tax. & Nom., Regnum Vegetabile Vol. 39. Utrecht.
16. Singh, Pande, Jain (2017-2018) Diversity of Angiosperms, Rastogi publication, Meerut
17. B.P, Pandey Botany for B.Sc. Students S. Chand, New Delhi

This course can be opted as an elective by the students of following subjects: Open to all but special for B.Sc. Biotech, B.Sc. Forestry B.Sc. Agriculture, B. Pharma, B.A. (Curators), B.A. Archaeology, B.A. Geology, BAMS Suggested Continuous Evaluation Methods:
Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Course prerequisites:

Qualification: To study this course, a student must have qualified 10+2 with Biology/ NSQF level 3 from Sector Skill Councils / Diploma holder from ITI in (Biology/ Agriculture/ Forestry).

Facilities: Smart and Interactive Class

Other Requisites: : Video collection, Books, CDs, Flora, Herbarium, Access to On-line resources, Display Charts

Lab Requisites: Microscopes (Compound, Stereo) Dissection box, stain, Herbarium, Herbarium press, Dryers, Grinder, Reference Flora

Suggested equivalent online courses:

1. <http://egyankosh.ac.in/bitstream/123456789/13096/1/Unit-5.pdf>
2. <https://www.for.gov.bc.ca/hfd/pubs/docs/wp/wp18.pdf>
3. <https://www.researchgate.net/publication/267510854> The Flowering Plants Handbook

Any Other:

Botanical Excursions: One teacher along with a batch not more than 7 students be taken for botanical excursion to places of Botanical interest, one in each term. If there are female students in a batch of 7 students, one additional lady teacher is permissible for excursion.

Each excursion will not be more than SEVEN days during college working days. T.A. and D.A. for teachers and non-teaching staff participating in excursions should be paid as per rules. Tour report duly certified by tour in charge teacher and Head of the Department should be submitted at the time of practical examination. For every study tour take the prior permission of the head of the department and Principal.

The marks will be counted under Internal assessment and external assessment both. In external assessment student will have to present his excursion report along with industrial training/central labs visits and BSI or Museum visits. In internal assessment he shall have to label the campus plants with botanical details/develop herbal/floristic garden/conservate plants in botanical garden/contribute specimens via collection.

A project supported along with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescences, flowers and fruits/

At least three field excursions at hills/Oceans/Deserts including one Compulsory excursion to Botanical Garden, FRI/BSI and Central National Herbarium (CNH). Central Research Institutes/Hot Spots

Internal Assessment	Marks
Test	10
Presentation/ Assignment (Charts/ Herbarium/ Projects/Rural Service/ Technology Dissemination/Research Orientation assignment/Lab Visits/Excursion/Industrial Training)	15
Total	25

Sunbeam College for Women, Bhagwanpur
B.Sc. - III Semester [BOTANY] Lab Plan of Dr. Ekta Shukla

Session- 2025-26

Course Code/ Title-BS2540302P, Plant Identification technology (PRACTICAL)

Reference Books:

Plant systematics- Gurucharan Singh

Plant Taxonomy- O.P. Sharma

Flowering Plants Identification and Aesthetic characterstics- Dr. S.k Gupta

Plant Taxonomy and Aesthetic Characters -B.P. Pandey, S.Chand Publication

Botany Practical Vol II- Bendre and Kumar- Rastogi Publication

Flowering Plants and Aesthetic Characteristics- Singh, Pande, Jain

S.No.	Unit	Month	Week	No. of lab work	Topics/ Experiments
1	I	JULY (13)	3rd	2	<p>Herbarium: Plant collecting, Preservation and Documentation- Stepwise Practicing Preparation of Herbarium : a. Field Equipments- Global Positioning System (GPS) instrument & collection of any 20 wild plant specimens. b. Learn to handle the Herbarium making tools c. Pressing and Drying of collected plant specimens d. Special treatments for all varied groups of plants e. Mounting on standard herbarium sheets f. Label the sheet using Standard method g. Organize and give Index Register Number</p> <p>Herbarium: Plant collecting, Preservation and Documentation- Stepwise Practicing Preparation of Herbarium : a. Field Equipments- Global Positioning System (GPS) instrument & collection of any 20 wild plant specimens. b. Learn to handle the Herbarium making tools c. Pressing and Drying of collected plant specimens d. Special treatments for all varied groups of plants e. Mounting on standard herbarium sheets f. Label the sheet using Standard method g. Organize and give Index Register Number</p>
			4th	2	Taxonomic Identification using plant characteristics -To study the taxonomic description (Plant Morphology, Anatomy Reproductive parts, Habit and adaptation anomalies) according to Bentham's Hooker system of classification in the following families: Malvaceae, Fabaceae (Papilionaceae),
			5th	Nil	
2	II & III	AUGUST (24)	1st	2	Family- Apiaceae, Family- Euphorbiaceae
			2nd	Nil	
			3rd	Nil	
			4th	2	Family- Apocynaceae Family- Lamiaceae
			5th	2	Family- Rutaceae, Family- Ranunculaceae

3	III & IV	SEPTEMBER (22)	1st	2	Family- Asteraceae, Family- Solanaceae
			2nd	2	Family- Rubiaceae, Family-Poaceae
			3rd	2	Making field note book and filling Sample of a page of field-book, used as in Botanical Survey of India. (On spot Identification during Excursion)
					Making field note book and filling Sample of a page of field-book, used as in Botanical Survey of India. (On spot Identification during Excursion)
			4th	2	Botanical Nomenclature & reporting Method: Author Citation, Effective Publication and Principle of Priority: To show a specimen paper on Basic structure of a taxonomic Research published on a new species in taxonomic journal Describe/compare (Four) flowers in semi-technical language giving V.S. of flowers, T.S. of ovaries, floral diagrams and Floral Formulae. Identify and assign them to their respective families giving reasons.
Botanical Nomenclature & reporting Method: Author Citation, Effective Publication and Principle of Priority: To show a specimen paper on Basic structure of a taxonomic Research published on a new species in taxonomic journal Describe/compare (Four) flowers in semi-technical language giving V.S. of flowers, T.S. of ovaries, floral diagrams and Floral Formulae. Identify and assign them to their respective families giving reasons.					
5th	Nil				
4	V & VI	OCTOBER (18)	1st	Nil	
			2nd	2	Computers- 1. Learning to use Excel, working with folder and windows utility.,
					Computers- Microsoft PowerPoint and Word, Computers- create and manage files and folder tree
			3rd	Nil	
			4th	2	2. Practice browsing of different sites using search engine. practice and understand different E-Mail services – Outlook, Yahoo mail, rediffmail etc
Practice Creating E-Mail accounts, Sending, Receiving & Storing of mails. 3.Create and participate in virtual conferencing in an interactive Zoom Meeting					
5th	Nil				
5	VII & VIII	NOVEMBER (13)	1st	2	Computer Application in taxonomy- Practical on Phylogenetic analysis
					Computer Application in taxonomy-Using of plant identification apps on android phones
			2nd	2	Create a Bonsai of any plant (Demo), Develop a miniature garden (Demo)
					Draw Layouts of various types of gardens (DEMO), Plant Propagation methods practice (DEMO)
			3rd	2	LEFT OVER PRACTICALS
LEFT OVER PRACTICALS					

B.Sc. Second Year

DETAILED SYLLABUS FOR

Diploma in Molecular Diagnostics and Genetic Counselling

Programme/Class: Diploma	Year: Second	Semester: Third
Subject: ZOOLOGY		
Course Code: BS2450301T	Course Title: Molecular Biology, Bioinstrumentation & Biotechniques	
Course outcomes: The student at the completion of the course will be able to have: <ul style="list-style-type: none">• A detailed and conceptual understanding of molecular processes viz. DNA to trait.• A clear understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level.<ul style="list-style-type: none">• Understanding of how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.• Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms.• How genes are regulated differently at different time and place in prokaryotes and eukaryotes		
Credits: 4	Core:Compulsory	
Max. Marks: 25+75	Min. Passing Marks: as per rules	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:4-0-0		
Unit	Topic	Total no. of lectures (60)
I	Process of Transcription <ul style="list-style-type: none">• Fine structure of gene• RNA polymerases• Transcription factors and machinery• Formation of initiation complex• Initiation, elongation and termination of transcription in prokaryotes and eukaryotes	7
II	Process of Translation <ul style="list-style-type: none">• The Genetic code• Ribosome• Factors involved in translation• Aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase• Initiation, elongation and termination of translation in prokaryotes and eukaryotes	7
III	Regulation of Gene Expression I • Regulation of gene expression in prokaryotes: lac and trpoperons in E. coli <ul style="list-style-type: none">• Regulation of gene expression in eukaryotes: Role of chromatin in gene expression• Regulation at transcriptional level, Post-transcriptional modifications: Capping, Splicing, Polyadenylation• RNA editing	8

IV	Regulation of Gene Expression II <ul style="list-style-type: none"> • Regulation of gene expression in eukaryotes: • Regulation at translational level, Post- translational modifications: protein folding etc • Intracellular protein degradation • Gene silencing, RNA interference (RNAi) 	8
V	Principle and Types of Microscopes <ul style="list-style-type: none"> • Principle of Microscopy and Applications • Types of Microscopes: light microscopy, dark field microscopy, phase-contrast microscopy, • Fluorescence microscopy, confocal microscopy, electron microscopy 	6
V	Centrifugation and Chromatography <ul style="list-style-type: none"> • Principle of Centrifugation • Types of Centrifuges: high speed and ultracentrifuge • Types of rotors: Vertical, Swing-out, Fixed-angle etc. • Principle and Types of Chromatography: paper, ionexchange, gel filtration, HPLC, affinity 	8
VI	Spectrophotometry and Biochemical Techniques <ul style="list-style-type: none"> • Principle and Types of Chromatography: paper, ionexchange, gel filtration, HPLC, affinity • Biochemical techniques: Measurement of pH, Preparation of buffers and solutions • Principle of colorimetry/Spectrophotometry: Beer-Lambert law • Measurement, applications and safety measures of radio-tracer techniques 	8
VII	Molecular techniques <ul style="list-style-type: none"> • Detection of nucleic acid by gel electrophoresis • DNA sequencing, DNA fingerprinting, RFLP • Polymerase Chain Reaction (PCR) • Detection of proteins, PAGE, ELISA, Western blotting 	8

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002).
5. Watson et al. Molecular Biology of the Gene. Pearson (2004).
6. Lewin. Genes VIII. Pearson (2004).
7. Pierce B. Genetics. Freeman (2004).
8. Sambrook *et al* . Molecular Cloning Vols I, II, III. CSHL (2001).
9. Primrose. Molecular Biotechnology. Panima (2001).
10. Clark & Switzer. Experimental Biochemistry. Freeman (2000)

Suggested Continuous Evaluation Methods:

Total Marks: 25

Class Test: 10 Marks

Assignment/Presentation/Project / Research orientation Assignments / quiz/Seminar: 15 Marks

Sunbeam College for Women, Bhagwanpur, Varanasi

B.Sc. III Semester (Session 2025-26)

Course Code: BS2550301T Course Title: Molecular Biology, Bioinstrumentation & Biotechniques

Teacher- Dr. Priti Srivastava

Suggested Readings: 1. Lodish et al: *Molecular Cell Biology*: Freeman & Co, USA (2004).
 2. Alberts et al: *Molecular Biology of the Cell*: Garland (2002).
 3. Cooper: *Cell: A Molecular Approach*: ASM Press (2000).
 4. Karp: *Cell and Molecular Biology*: Wiley (2002).
 5. Watson et al. *Molecular Biology of the Gene*. Pearson (2004).
 6. Lewin. *Genes VIII*. Pearson (2004).
 7. Pierce B. *Genetics*. Freeman (2004).
 8. Sambrook et al. *Molecular Cloning Vols I, II, III*. CSHL (2001).
 9. Primrose. *Molecular Biotechnology*. Panima (2001).
 10. Clark & Switzer. *Experimental Biochemistry*. Freeman (2000)

S. No.	Unit	Month	Week	No. of lectures	Topics
1	V	July	3rd	3	Introduction, Principle of Microscopy and Applications; Types of Microscopes: light microscopy
			4th	3	Principle of Microscopy and Applications; Types of Microscopes: light microscopy
			5th	1	dark field microscopy,
2	V & VI	August	1st	2	phase-contrast microscopy, Fluorescence microscopy,
			2nd	2	confocal microscopy, electron microscopy
			3rd	2	Principle of Centrifugation, Types of Centrifuges: high speed and ultracentrifuge
			4th	3	Types of rotors: Vertical, Swing-out, Fixed-angle etc.
			5th	3	Principle and Types of Chromatography: paper
3	VI & VII	September	1st	2	ion exchange, gel filtration, HPLC, affinity chromatography
			2nd	3	Biochemical techniques: Measurement of pH,
			3rd	3	Preparation of buffers and solutions
			4th	3	Principle of Colorimetry/Spectrophotometry: Beer-Lambert law
			5th	0	
4	VII	October	1st	0	
			2nd	3	Measurement, applications and safety measures of radio-tracer techniques
			3rd	2	Detection of nucleic acid by gel electrophoresis
			4th	2	DNA sequencing; Human genome sequencing
			5th	2	DNA fingerprinting, RFLP; Polymerase Chain Reaction (PCR)
5	VII & VIII	November	2nd	0	Detection of proteins, PAGE,
			3rd	3	ELISA and different types of Eliza
			4th	3	Western blotting technique

Sunbeam College for Women, Bhagwanpur, Varanasi

B.Sc. III Semester (Session: 2025-26)

Molecular Biology, Bioinstrumentation & Biotechniques (BS2550301T)

Teacher- Dr. Madhumita Srivastava

Reference Books:					
1. Lodish et al: Molecular Cell Biology					
2. Alberts et al: Molecular Biology of the Cell					
3. Molecular Biology, Bioinstrumentation and Biotechniques by Dr. Veer Bala Rastogi					
4. Cell and Molecular Biology by De Robertis					
5. Molecular Biology by P.S. Verma & V. K. Agarwal					
Sl. No.	Unit	Month	Week	No. of Lectures (44)	Topics
1	I	July	3rd	0	
			4th	3	Process of Transcription- Gene structure
			5th	3	RNA polymerase Transcription factors and machinery
2	I & II	August	1st	0	
			2nd	3	Formation of initiation complex Initiation, elongation and termination of Transcription in prokaryotes
			3rd	3	Initiation, elongation and termination of Transcription in eukaryotes
			4th	3	Process of Translation- The Genetic code Ribosome
			5th	3	Factors involved in Translation Aminoacylation of tRNA, tRNA- identify aminoacyl tRNA synthetase
3	II	September	1st	3	Initiation, elongation and termination of Translation in prokaryotes
			2nd	3	Initiation, elongation and termination of Translation in prokaryotes contd.
			3rd	2	Initiation, elongation and termination of Translation in eukaryotes
			4th	3	Initiation, elongation and termination of Translation in eukaryotes contd.
			5th	0	
4	III	October	1st	0	
			2nd	3	Regulation of Gene Expression- I Regulation of gene expression in prokaryotes
			3rd	3	Regulation of Gene Expression in eukaryotes
			4th	0	
			5th	3	Regulation at transcriptional level Post- transcriptional modifications RNA editing
5	IV	November	1st	0	
			2nd	2	Regulation of Gene Expression II- Regulation of gene expression in eukaryotes
			3rd	3	Regulation of gene expression in eukaryotes contd.
			4th	1	Regulation at translational level Intracellular protein degradation Gene silencing, RNA interference

Programme/Class: Diploma	Year: Second	Semester: Third
Subject: ZOOLOGY		
Course Code: BS2450302P	Course Title: Bioinstrumentation & Molecular Biology Lab	
Course outcomes: The student at the completion of the course will be able to		
<ul style="list-style-type: none"> • Understand the basic principles of microscopy, working of different types of microscopes • Understand the basic techniques of centrifugation and chromatography for studying cells and separation of biomolecules • Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer and use them in Biochemistry. • Learn about some of the commonly used advance DNA testing methods 		
Credits: 2	Core: Compulsory	
Max. Marks: 25+75	Min. Passing Marks: as per rules	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 0-0-4		
Unit	Topic	Total No. of Lectures (60)
I	1. To study the working principle and Simple, Compound and Binocular microscopes. 2. To study the working principle of various lab equipments such as pH Meter, Electronic balance, use of glass and micropipettes, Laminar flow, Incubator, Waterbath, Centrifuge, Chromatography apparatus, etc	15
II	1. To prepare solutions and buffers. 2. To measure absorbance in Colorimeter or Spectrophotometer. 3. Demonstration of differential centrifugation to fractionate different components in a mixture 4. To prepare dilutions of Riboflavin and verify the principle of spectrophotometry. 5. To identify different amino acids in a mixture using paper chromatography. 6. To estimate amount of DNA using spectrophotometer	20
III	1. Study the models- lac operon , tRNA, DNA, try-operon, transcription and translation . 2. Demonstration of DNA extraction from blood or tissue samples.	10
IV	Virtual Labs (Suggestive sites) www.labinapp.com www.uwlax.edu www.labster.com www.onlinelabs.in www.powershow.in https://vlab.amrita.edu 15 21 info@premiereducationaltechnologyies.com https://li.wsu.edu	15
Suggested Readings: 1. Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001). 2. Primrose. Molecular Biotechnology. Panima (2001). 3. Clark & Switzer. Experimental Biochemistry. Freeman (2000)		
Course Books published in Hindi may be prescribed by the Universities and Colleges		
Suggested Continuous Evaluation Methods: Class Test: 10 Marks Written Assignment/Presentation/Project / Research orientation assignment/ quiz/Seminar: 15		

Sunbeam College for Women, Bhagwanpur, Varanasi

B.Sc. III Semester (Session 2025-26)

Course Code: BS2550302P Course Title: Bioinstrumentation & Molecular Biology Lab

Teacher- Dr. Priti Srivastava

1. Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001).

2. Primrose. Molecular Biotechnology. Panima (2001).

3. Clark & Switzer. Experimental Biochemistry. Freeman (2000)

S. No.	Unit	Month	Week	No. of lectures	Topics
1	I	July	3rd	2	To study the working principle and Simple, Compound and Binocular microscopes.
			4th	2	To study the working principle and Simple, Compound and Binocular microscopes.
			5th	2	To prepare solutions and buffers.
2	II	August	1st	0	
			2nd	1	To prepare solutions and buffers.
			3rd	2	To measure size of microscopic objects using microscope
			4th	2	To study the working principle of various lab equipments such as pH Meter, Electronic balance,
			5th	2	To study the working principle of various lab equipments such as glass and micropipettes, Laminar flow, Incubator
3	III	September	1st	2	To study the working principle of various lab equipments such as Waterbath, Centrifuge,
			2nd	2	To study the working principle of pH Meter and , Electronic balance, use of glass and micropipettes
			3rd	2	To study the working principle and use of Chromatography apparatus
			4th	2	Demonstration of DNA extraction from blood or tissue samples.
			5th	0	
4	III & IV	October	1st	0	
			2nd	2	To measure absorbance in Colorimeter
			3rd	2	To measure absorbance in Spectrophotometer
			4th	2	To prepare dilutions of Riboflavin and verify the principle of spectrophotometry
			5th	2	To estimate amount of DNA using spectrophotometer
5	IV	November	1st	0	
			2nd	2	Demonstration of differential centrifugation to fractionate different components in a mixture.
			3rd	2	Virtual lab

Programme: B.Sc		Year: Second	Semester: Third
Subject: Compulsory			
Course Code: 250306C		Course Title: Human Values and Environment Studies	
Course outcomes: The objective of this course is to develop value system and awareness for environmental sustainability.			
Credits: 2		Co-Curricular Course	
Max. Marks: 100			
Total No. of Lectures: 30			
Unit	Topics	No. of Lectures Total = 30	
I	Human Values- Introduction- Values, Characteristics, Types, Developing Value system in Indian Organisation, Values in Business Management, value based Organisation, Trans-cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam's view on role of parents and teachers. Human Values and Present Practices – Issues: Corruption and Bribe, Privacy Policy in Web and social media, Cyber threats, Online Shopping etc. Remedies UK Bribery Act, Introduction to sustainable policies and practices in Indian Economy. Principles of Ethics, Secular and Spiritual Values in Management- Introduction- Secular and Spiritual values, features, Levels of value Implementation. Features of spiritual Values, Corporate Social Responsibility- Nature, Levels, Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates.	07	
II	Holistic Approach in Decision making- Decision making, the decision making process, The Bhagavad Gita: Techniques in Management, Dharma and Holistic Management. Discussion through Dilemmas – Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context, Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security, Dilemma on Organic food, Dilemma on standardization, Dilemma on Quality standards. Case Studies.	08	
III	Ecosystem: Concept, structure & functions of ecosystem: producer, consumer, decomposer, foodweb, food chain, energy flow, Ecological pyramids. Conservation of Biodiversity- In-situ & Ex- situ conservation of biodiversity Role of individual in Pollution control; Human Population & Environment Sustainable Development. India and UN Sustainable Development Goals Concept of circular economy and entrepreneurship.	07	
IV	Environmental Laws: International Advancements in Environmental Conservation Role of National Green Tribunal, Air Quality Index, Importance of Indian Traditional knowledge on environment, Bio assessment of Environmental Quality, Environmental Management System, Environmental Impact Assessment and Environmental Audit.	08	
Suggested Readings:			
<ol style="list-style-type: none"> 1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal et.al 2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel. 3. Human Values by A. N. Tripathi New Age International 4. Environmental Management by N.K. Uberoi 5. https://www.un.org/sustainabledevelopment/sustainable-development-goals/ 6. https://www.india.gov.in/my-government/schemes 7. https://www.legislation.gov.uk/ukpga/2010/23/contents 8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921 			
This course can be opted as Co-Curricular Course by the students of following subjects: Open for all			
Suggested Continuous Evaluation Methods:			
In addition to the theoretical inputs the course will be delivered through case studies and dilemmas. Assignments, Presentation, Group Discussions. This will instill in student a sense of decision making and practical learning. The course participants can be evaluated on the following structure.			
<ul style="list-style-type: none"> ➤ Assignments (10) ➤ Presentation (10) ➤ Attendance (5) ➤ Final exam (75) 			

B. Sc. Third Semester

Co-Curricular

Human Values and Environmental Studies (2025-26)

References:

1. A foundation course in Human Values and Professional Ethics by RR Gaur, R Sangal et al
2. JUSTICE What's the Right Thing to Do? Michael J Sandel
3. Human Values by A N Tripathi New Age International
4. Environmental Management by N K Uberoi
5. <https://www.un.org/sustainabledevelopment/sustainable-development-goals>
6. <https://www.india.gov.in/my-government-schemes>
7. <https://www.legislation.gov.uk/ukpga/2010/23/contents>
8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN 9780141918921

S. No.	Unit	Month	Week	No. of Lectures	Topics
1	I	July	3rd	2	Introduction Values, Characteristics, Types; Developing Value system in Indian Organisation;
2			4th	2	Values in Business Management; Value based Organisation; Trans cultural Human values in Management
			5th	2	Swami Vivekananda's philosophy of Character Building; Gandhi's concept of Seven Sins, APJ Abdul Kalam view on role of parents and Teachers
3	II	August	1st	2	Human Values and Present Practices Issues Corruption and Bribe , Privacy Policy in Web and Social Media
			2nd	2	Cyber threats ,Online Shopping etc; Remedies UK Bribery Act, Introduction to sustainable policies and practices in Indian Economy
	3rd		2	Secular and Spiritual Values in Management Introduction Secular and Spiritual values, features ,	
	III		4th	2	Levels of value Implementation, Features of spiritual Values; Corporate Social Responsibility Nature, Levels, Phases and Models of CSR;
			5th	2	Corporate Governance CSR and Modern Business Tycoons Ratan Tata, Azim Premji and Bill Gates
1st		2	Holistic Approach in Decision making Decision making, the decision making process; The Bhagavad Gita Techniques in Management, Dharma and Holistic Management		
4	IV	September	2nd	2	Discussion through Dilemmas -Dilemmas in Marketing and Pharma Organisations, moving from Public to Private - monopoly context , Dilemma of privatisation, Dilemma on liberalization, Dilemma on social media and cyber security, Dilemma on Organic food , Dilemma on standardization ,Dilemma on Quality standards
			3rd	2	Ecosystem Concept, structure & functions of ecosystem producer, consumer, decomposer, foodweb, food chain, energy flow, Ecological pyramids
			4th	2	Conservation of Biodiversity In situ & Ex situ conservation of biodiversity Role of individual in Pollution control; Human Population & Environment, Sustainable Development
			2nd	2	India and UN Sustainable Development Goals, Concept of circular economy and entrepreneurship; Environmental Laws
4	IV	October	3rd	2	International Advancements in Environmental Conservation; Role of National Green Tribunal, Air Quality Index;
			4th	2	Importance of Indian Traditional knowledge on environment, Bio assessment of Environmental Quality
			5th	2	Environmental Management System, Environmental Impact Assessment and Environmental Audit

Programme: B.Sc.	Year: Second	Semester: Third
Subject: Vocational		
Course Code: 250307V	Course Title: Self-Regulatory Mode & Techniques	
Course outcomes: Through this course, students will be guided in building the fundamental competencies and personal qualities essential for a career in counselling. Also, this course contributes to long-term mental health benefits & fosters resilience in dealing with future difficulties.		
Credits: 3		Vocational / Skill Development
Max. Marks: 25+75		
Total No. of Lectures: 45		

Unit	Topics	No. of Lectures
I	Introduction to Counselling: Concept of Counselling and Guidance, Elements of Counselling. Differences and Relations between Counselling and Guidance. Counselling Process- Identifying the issue & Coping with Feelings. Ethics in Counselling – Confidentiality, Consent and Boundaries.	10
II	Counselling Techniques and Skills: Communication and Active Listening - Listening to Silences. Reflective Skills- Restating, Paraphrasing, Summarizing. Probing Skill- Questioning, responding to clients' questions. Attending skills - Posture, Eye contact, Seating arrangement. Qualities of a Counsellor- Empathy, Patience, Warmth, Optimistic.	10
III	Group Counselling: Principles of Group Counselling. Benefits of Group Counselling: Shared struggles, Accountability, Self-evaluation & cost-effectiveness. Group Counselling vs. Individual counselling.	10
IV	Counselling- Healing of Mental Health: Stress, Anxiety, Depression, Attention problems. Crisis Intervention and Suicide Prevention. Developing Self-Management Skills- Meditation, Gardening, Swimming, Drawing Mandalas, Music, Dancing.	15

Suggested Readings:

1. Burnard, P. (1999). Counselling Skills Training, New Delhi: Viva Books Private Limited
 2. Culley, S and Bond, T (2006). Integrative Counselling skills in action, London: Sage Publications
 3. Foundations of Mental Health: A Manual for Undergraduate Students" by K. S. Shaji and G. S. Ravindran, Publisher: NIMHANS
 4. Manthei, R. (1997). Counselling: The skill of finding solutions to problems, London: Routledge
 5. Rao, S.N. (1981). Counselling Psychology. New Delhi: Tata McGraw Hill Publishing Company Limited.
- Note- **Latest edition of the text books should be used.**

This course can be opted as an elective by the students of following subjects:

Open for all

Suggested Continuous Evaluation Methods: Continuous Internal Evaluation shall be based on allotted Assignment and Class Tests. The marks shall be as follows:

Assessment and Presentation of Assignment	(04 marks)
Class Test-I (Objective Questions)	(04 marks)
Class Test-II (Descriptive Questions)	(04 marks)
Class Test-III (Objective Questions)	(04 marks)
Class Test-IV (Descriptive Questions)	(04 marks)
Overall performance throughout the Semester (includes Attendance, Behaviour, Discipline, Participation in Different Activities)	(05 marks)

Sunbeam College for Women, Bhagwanpur, Varanasi

B. Sc. Third Semester

Vocational Subject

Self-Regulatory Modes & Techniques (250307V)

Subject Teacher: Ms. Nalinee Pathak

Total Lectures: 34 (2 lectures per week)

Duration: 17 July 2025 – 17 November 2025

Reference Books:					
1. Burnard, P. (1999). Counselling Skills Training, New Delhi: Viva Books Private Limited.					
2. Culley, S and Bond, T (2006). Integrative Counselling skills in action, London: Sage Publications.					
3. Foundations of Mental Health: A Manual for Undergraduate Students by K. S. Shaji and G. S. Ravindran, NIMHANS.					
4. Manthei, R. (1997). Counselling: The skill of finding solutions to problems, London: Routledge.					
5. Rao, S.N. (1981). Counselling Psychology. New Delhi: Tata McGraw Hill Publishing Company Limited.					
S.N.	Unit	Month	Week	No. of Lectures	Topics
1.	I	July (06 days)	4 th	2	Introduction: Concept of Counselling & Guidance, Elements of Counselling
			5 th	2	Differences & Relations between Counselling & Guidance, Counselling Process – Identifying Issues
2.	I & II	August (12 Days)	1 st	--	*****
			2 nd	2	Coping with Feelings in Counselling Process
			3 rd	2	Ethics in Counselling – Confidentiality, Consent and Boundaries
			4 th	2	Communication & Active Listening – Listening to Silences
			5 th	2	Reflective Skills – Restating, Paraphrasing, Summarizing
3.	II & III	September (11 Days)	1 st	2	Probing Skills – Questioning, Responding to Clients
			2 nd	2	Attending Skills – Posture, Eye Contact; Qualities of a Counsellor
			3 rd	2	Principles & Benefits of Group Counselling
			4 th	2	Group Counselling vs Individual Counselling
			5 th	--	*****
4.	III & IV	October (09 Days)	1 st	--	*****
			2 nd	2	Stress, Anxiety, Depression
			3 rd	2	Attention Problems & Crisis Intervention
			4 th	--	Suicide Prevention Strategies
			5 th	2	Self-Management Skills – Meditation, Gardening, Mandala Drawing
5.	IV	November (06 days)	1 st	--	*****
			2 nd	2	Self-Management Skills – Music, Dancing, Swimming (Therapeutic Aspects)
			3 rd	2	Revision (Unit I & II)
			4 th	2	Revision (Unit III & IV), Exam Preparation
			5 th	--	*****